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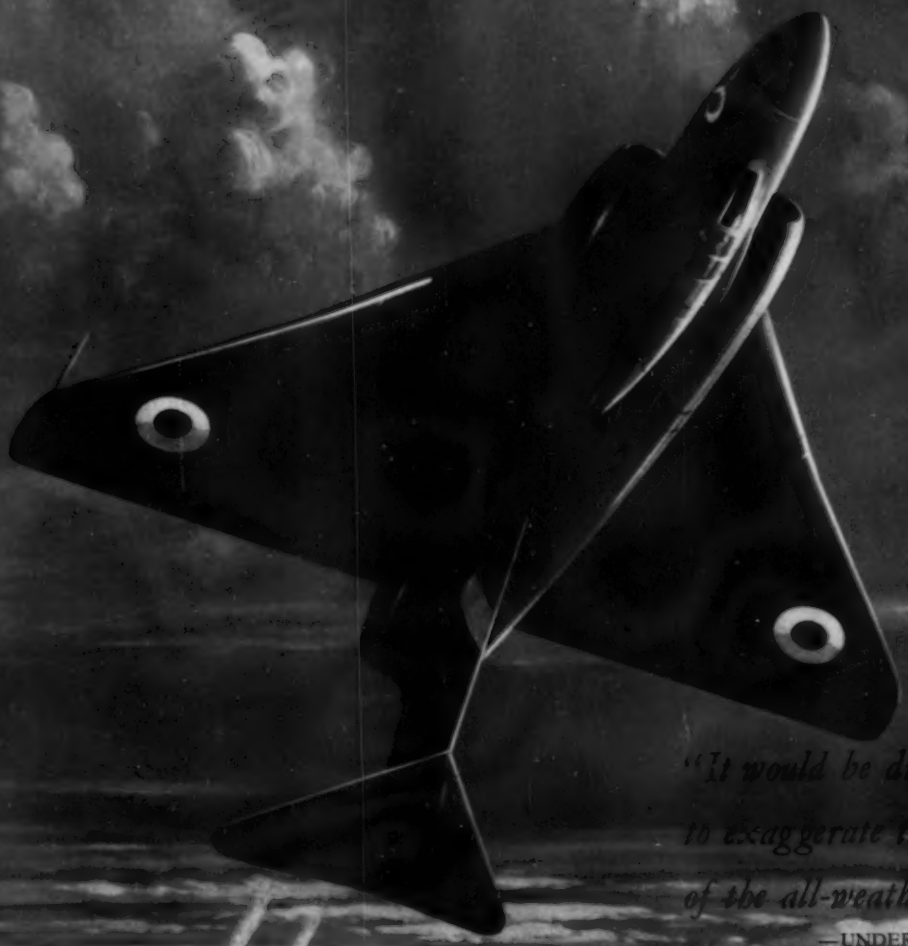

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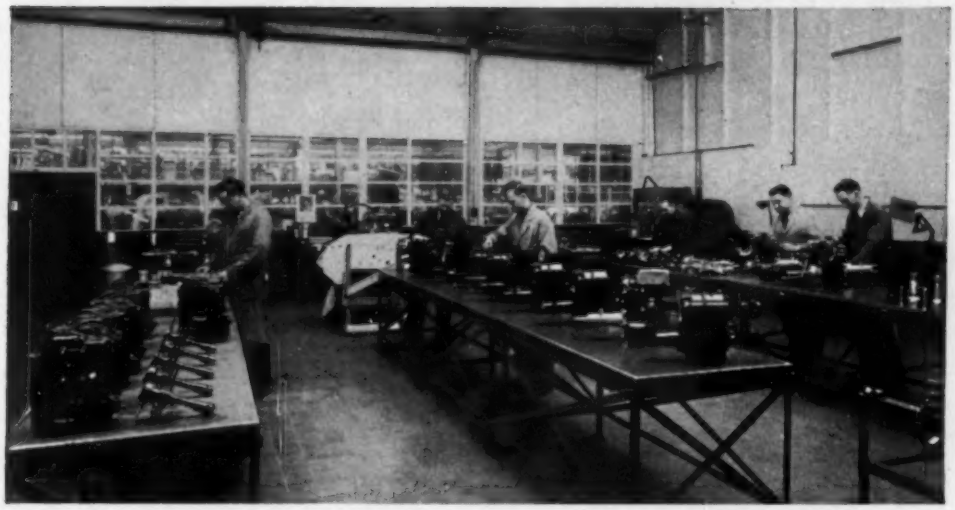

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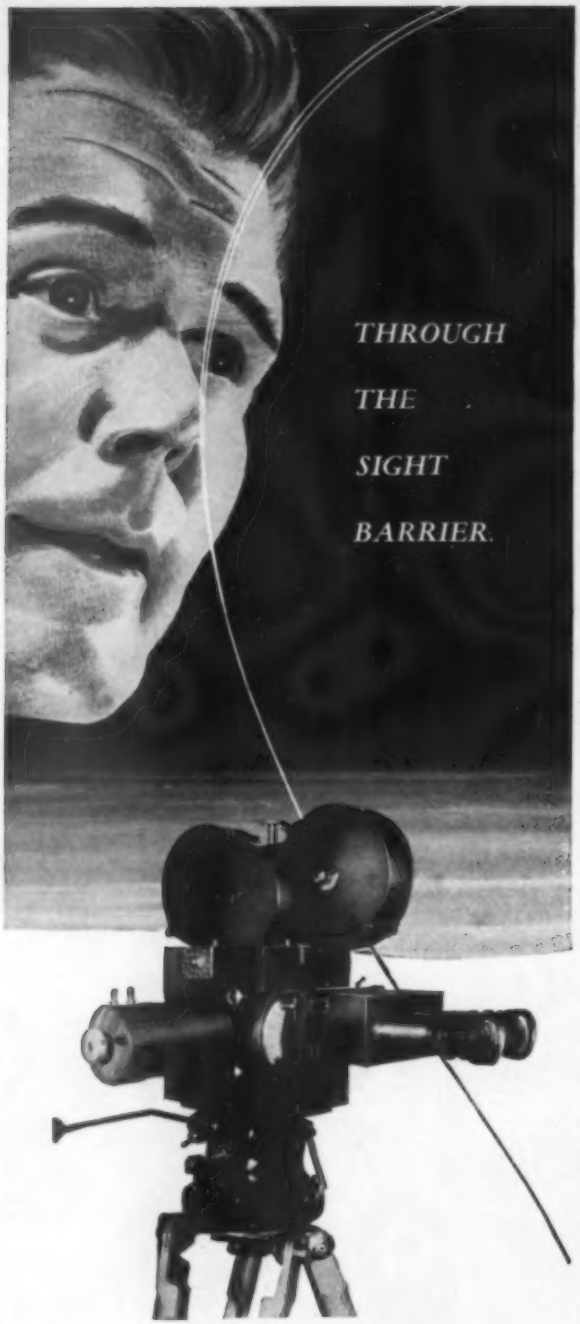

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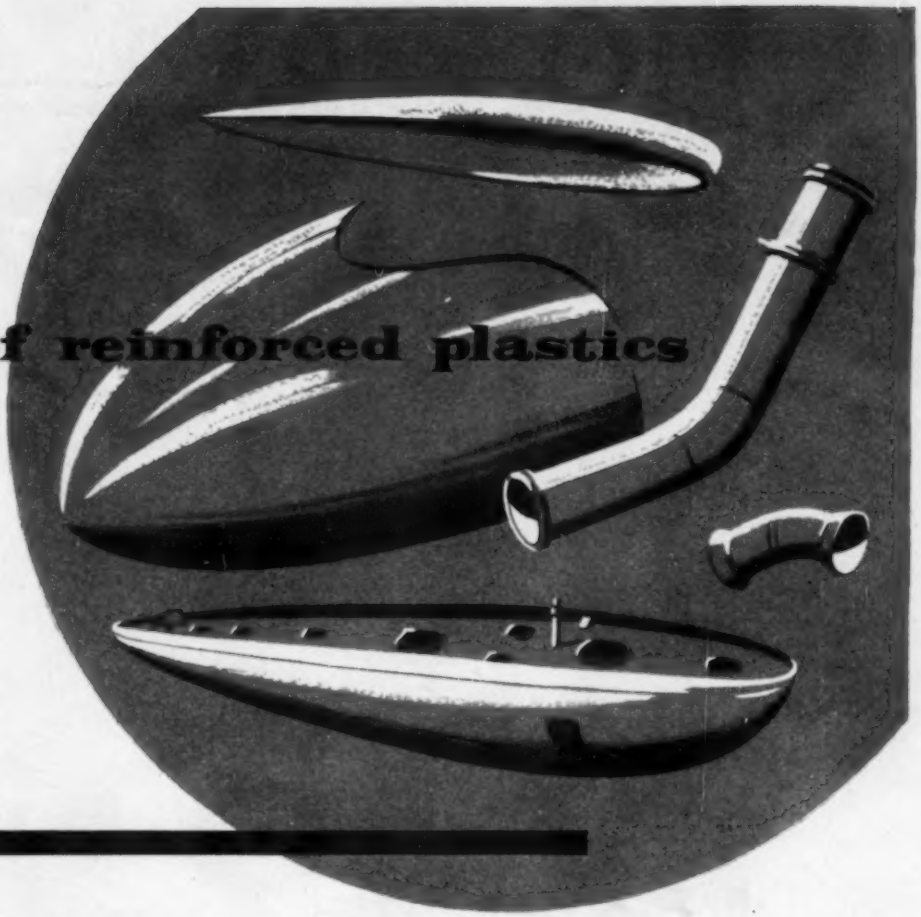

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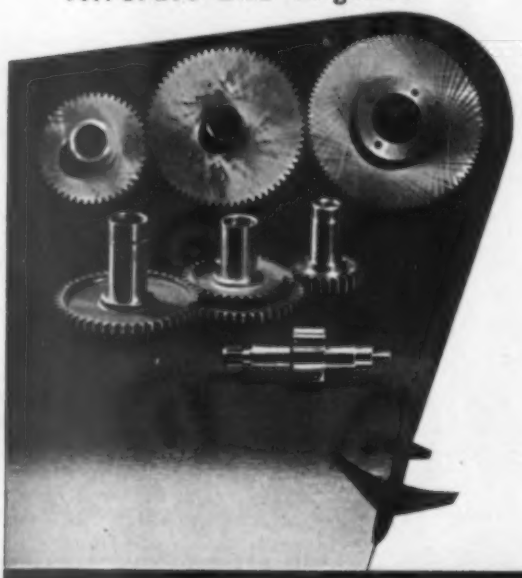

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EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

ART EDITOR
JOHN YOXALL

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Sprint, Crawl and Shuffle

A FLIGHT to Paris last week, for the closing session of the I.A.T.A. annual general meeting, provided an excellent opportunity to browse through the text of the report delivered a few days earlier by the Association's director-general, Sir William Hildred. The report included some remarks on "facilitation," by which is meant the abolition of frontier procedures which impede swift, smooth and economic travel. The costly and time-consuming character of these procedures is especially marked on short-haul European international routes, such as that between London and Paris, so we found ourselves in an ideal position to appreciate the sense of Sir William's remarks.

Perhaps I.A.T.A. and I.C.A.O., who are jointly waging war against red tape, should have chosen a less esoteric title for their campaign. Asserting that government response to date has effected only a third of the total easement and efficiency thought possible, Sir William confesses "I could only wish that governments loved the abstract idea of facilitation a little less and hated red tape a little more." He adds that if the airlines are to have the full benefit of simplification of government procedures, they must also follow through by a similar simplification of their own procedures.

Easily overlooked is the fact that air journey speeds, calculated on a city-to-city basis (which, after all, is the only aspect of interest to the traveller) can be as low as 50 m.p.h. Between London and Paris, for example, the period spent airborne at 250 m.p.h. is little more than 30 per cent of the total elapsed time. The journey itself is in five phases—a sprint between airports; two crawls between city-centres and airports; and a near-motionless shuffle at each airport.

Many authorities agree that, eventually, air journeys of up to 200-300 miles will be flown by helicopters or convertiplanes, averaging perhaps 150 m.p.h. In this way the jerky, devious process of crawl and sprint will be replaced by a direct jog-trot. But many technical problems have to be solved before mass helicopter travel becomes a reality, and the bright prospect of direct city-to-city air travel should not divert all our attention from ways of improving the existing system.

More speed, less haste

Oddly enough the degrees of effort devoted to methods of expediting the different stages of short-haul air journeys seem almost inversely proportionate to their effect in terms of time. Quickening the sprint, by introducing faster aircraft, does comparatively little to reduce journey time on short stages.

Increased use of rail rather than roads seems the most practical way of overcoming the city-airport crawl problem; but the difficulty here is lack of agreement between transport and other authorities, not so much on "how it shall be done?" as on "who shall pay for it?" Meanwhile, it seems that very little thought is being given to a simple and inexpensive way of speeding-up journey times—by cutting down the tedious, tiring "shuffle" periods spent in the airport terminal before embarking on, and after stepping off, the aircraft. Which brings us back to the subject of facilitation.

Is it really necessary, for example, for the passenger to report to the airport a full half-hour before the scheduled departure-time of a 1¼-hour flight? Is it necessary for that same passenger to pass through eleven separate points of check, scrutiny or purchase in the course of a single journey? These were our experiences on the journey mentioned above, though London-Paris is by no means the outstanding example of European inter-city routes afflicted by time-wasting formalities.

Questions of this kind are being asked of governments all over the world by the I.A.T.A. and I.C.A.O. facilitation experts, whose campaign will in due course save millions of pounds and, incidentally, will make air travel more pleasant for everybody. But action on a global scale is inevitably a slow process, and there is no doubt that individual airlines can, by exhortation and example, do much to boost the campaign against red tape.

FROM ALL QUARTERS

C. of A. Changes Foreshadowed

EVERYTHING to do with the Comet 1s will remain in abeyance until such time as the results of the present intensive investigations have been made known. Each new airliner will, however, feel the repercussions of the Rome disasters, and it must be expected that important changes will be made in the requirements leading up to the granting of Certificates of Airworthiness.

It must now be expected that an even more exacting series of tests will be required to obtain a C. of A. And this of necessity means a lengthier and more expensive test period. After the Comet, the first British aircraft to be so affected is the Britannia. A turboprop type, its speed is lower than that of the Comets and so also is its cruising height; but the pressure differential for the cabin is still considerable.

If, in fact, more testing—including water-tank testing of the fuselage, of the kind illustrated on p. 474 in connection with the Comet—is called for, and both a greater total of flying hours for the type and from an individual machine are demanded as a condition for a passenger-carrying C. of A., then it is hard to see how Britannias can enter service within several months of the time originally announced.

Other high-performance aircraft will be similarly affected, but there is more time in their case to build additional main units of the airframe for testing, to set up full-scale mock-ups for controls, complete electrical systems and so on, and to include many more specific tests and observations of structural behaviour in the schedules for each test flight.

Looking a little further ahead, it seems that it will be necessary for manufacturers to provision and budget for more prototypes (flying and non-flying), for more pre-service air testing and for more ground test equipment and mock-ups. To revert to the Britannia, it is fortunate that the Bristol Company provided themselves with a non-flying prototype a long time ago.

Sir Hudson Fysh on Qantas Plans

AUSTRALIA'S international airline looks forward to linking up with B.O.A.C. at San Francisco in 1955, thus forming a British round-the-world route. This news was given by Sir Hudson Fysh, co-founder, chairman and managing director of Qantas Empire Airways, at a conference held before his departure from London for Sydney on Monday night.

Sir Hudson, who flew to this country for the S.B.A.C. Show and afterwards attended the I.A.T.A. meeting in Paris, said that B.O.A.C. already had rights to operate from London to San Francisco, and that only the final details required negotiation. San Francisco is already linked to Sydney by the Qantas Super Constellation service (which, incidentally, is attracting very heavy bookings and has a waiting list at the U.S. end).

From Sydney, Qantas and B.E.A. operate in partnership with Constellation 749As (plus a new once-weekly Super Constellation service by Qantas). After January or February next year, all the Australian Airline's services on the London-Sydney route will be operated with Super Constellations, leaving the earlier version in service only on the Indian Ocean route between Sydney and Johannesburg.

Another item of Qantas news concerns the inauguration, on September 14th, of an additional weekly service between Sydney and San Francisco. Known as "The Connoisseur," the service is for first-class passengers only. Sleeper chairs are provided for the 39 passengers, and four cabin attendants are carried. All drinks are free, and there is no surcharge.

FOR WASHINGTON: The Series 2 Executive Heron, referred to below.

Ambassadorial Heron

IN the photograph above is seen the first de Havilland Heron to go into service in the United States of America. A Series 2 Executive model, it is destined to be used by the British Joint Services Mission and as a personal aircraft by the British Ambassador, Sir Roger Makins.

Delivered to the Ministry of Supply on September 13th, the aircraft is, at the time of writing, about to be flown to Washington *via* Keflavik, Bluie West and Goose Bay.

Designed to carry eight passengers in very considerable comfort, the Series 2 Executive Heron weighs 13,000 lb fully loaded. With its full complement of passengers, and 44 lb of baggage each, it has a range of 850 miles with fuel allowances for instrument-flight conditions, or 1,100 miles under V.F.R. The Series 2 Heron, which has a retractable undercarriage, cruises at 183 m.p.h. on the power of four Gipsy Queen 30 Mk. 2 engines.

B.E.A. Helicopter Plans

SPEAKING at Sywell, Northampton, on September 16th to the conference of the Aerodrome Owners Association, Mr. P. G. Masefield, chief executive of B.E.A., said that the Corporation's first international helicopter service would operate between London and Brussels in 1958. Brussels was chosen because Sabena intended to operate a reciprocal service. Mr. Masefield stressed that the programme by which 50-seat, 150 m.p.h. helicopters would take over short-haul domestic and international inter-city services was not expected to begin until the early 1960s. The S-55 service between London Airport and the South Bank, he said, would start next year.

BIGGIN HILL became a focal point for a quarter of a million people last week-end when, as recorded on page 503, those who fought in the Battle of Britain held their reunion there. In this picture an ageing Lincoln and a Varsity are parked for examination while a production Valiant is displayed overhead.

FIRST AIR PICTURE of the U.S. Navy's R7V-2 turboprop Super Constellation; claimed to be the world's fastest airscrew-driven transport, it is powered by four P. and W. T34s, as described and illustrated on this page.

Boeing 707 Testing

FLIGHT testing of the Boeing 707 jet transport prototype, which was grounded on August 5th by damage to the nose-wheel assembly, were due to be resumed this week. The test programme, say Boeing, will include flights "closer to the speed of sound than any transport has ever done." The prototype has recently been fitted with a drag parachute and extra ballast, and had minor modifications made to the hydraulic system.

The tests, during all of which the air-conditioning and pressurization system will be in operation, will include investigation of stability, control and stall characteristics throughout the c.g range, and with one or two engines shut down. Emergency descents at 20,000ft/min will be made with air brakes and wheels extended, and on one flight the "707" will be subjected, by a high-speed pull-up, to 80 per cent of the design-limit g load.

Bomb Accident at Marham

THE explosion of two 1,000-lb H.E. bombs on the ground caused damage to eleven parked Canberras at R.A.F. station Marham, Norfolk, on Monday last. The bombs, which were being taken to the aircraft in preparation for an operation in Exercise Morning Mist, rolled off trolleys being towed behind a tractor, and exploded immediately. None of the remaining eight bombs exploded, but six of the Canberras were subsequently stated to be damaged beyond repair. Chief Technician W. Bawley, the tractor driver, was critically injured, and subsequently died. Fortunately, there were no other serious casualties.

As the bombs would presumably not have been fused before being towed to the aircraft, the cause of the accident is obscure. It may be recalled, however, that similar explosions did take place during World War II.

Pratt and Whitney Turboprop Details

AMERICA'S leading turboprop in the medium-to-high-power class is the Pratt and Whitney T-34. Interior details were recently shown for the first time, when the accompanying photograph was released. Four of these units provide the power for the turboprop Super Constellation illustrated above; the machine depicted is the first prototype of this design to fly, and it has been developed with the designation R7V-2 for the U.S. Navy. The Douglas YC-124B is also fitted with T-34s.

The T-34 is very compact, its overall diameter being only a fraction over 34in. The length is 157.4in. Of 6.7:1 ratio, the T-34's all-steel compressor has thirteen stages; bleeds from sixth and eighth stages can be seen in the photograph. Behind the canannular combustion chamber are three turbine stages, all of which are directly bolted to the compressor. The reduction gear, which appears to incorporate a torquemeter, has a ratio of 11 to 1 in two stages. The intake is de-iced by hot air tapped from the back of the compressor, and this too can be seen in the photograph. The de-icing air passes through the hollow inlet guide-vanes.

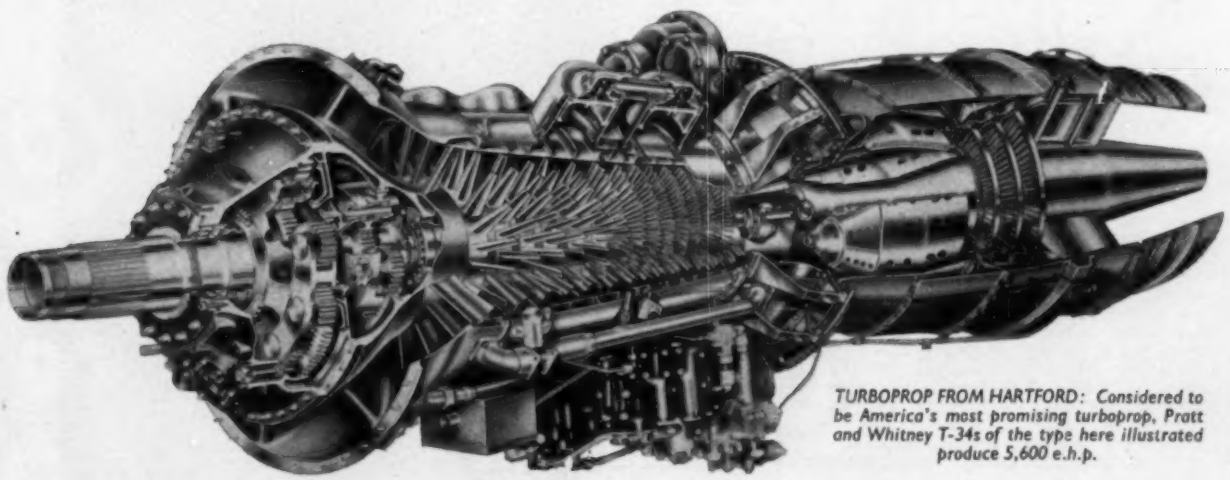
Sea-level take-off power of the T-34 is 5,600 e.h.p. at 11,000 r.p.m. and the cruising output at 10,570 r.p.m. is 33,740 s.h.p., plus thrust to give a total of 4,145 e.h.p. The engine weighs 2,564 lb and construction is almost entirely of stainless steel, with the exception of the light-alloy reduction gear and intake casing. A windmilling brake is built into the unit.

A specific consumption of 0.64 lb/h.p./hr is quoted. The unit completed its 50-hour pre-flight test in December, 1951.

New Gloucester Apprentices' School

THE official opening of a new apprenticeship training school at Gloucester to serve the Rotol and British Messier companies was performed by Lord Hives (chairman and joint managing director of Rolls-Royce, Ltd.) on Friday last. Before the ceremony, in an address to apprentices, parents and guests, Lord Hives had reminded them that the Rotol company had been created by the Bristol and Rolls-Royce firms—"some really famous parents"—and had pointed out that Rotol's and British Messier's belief in the future expansion of their work had here been backed by a large capital investment for the new school.

Sir John Evetts, managing director of Rotol, Ltd., announced that the joint training scheme of his company and British Messier was now in its 16th year. There were now 200 apprentices under training, and the eventual target was 250. He also mentioned Australian interest in the new training school, and the recent visit of Sir John Jensen, who was until 1949 Secretary of the Australian Department of Supply and Development. Lord Hives, Sir John Evetts, representatives of and heads of local universities, schools and technical colleges later inspected the new premises, which have finely equipped machine shops and drawing offices.



TURBOPROP FROM HARTFORD: Considered to be America's most promising turboprop, Pratt and Whitney T-34s of the type here illustrated produce 5,600 e.h.p.

PROGRESS with the CARAVELLE

France's First Jet Airliner Well Advanced at Toulouse

PROGRESS with the first prototype of the S.E.210 Caravelle, at Toulouse, is excellent, though superficially the airframe does not differ greatly from when it was photographed last April. It is the way with aeroplanes that there is an apparent hiatus between completion of the shell and completion of the aircraft. With the complicated interior of an airliner this stagnant period may extend to a year. In the case of the Caravelle, the fuselage was removed from its jig on March 13th, 1954, and, after some detail operations, was mounted on the finished mainplane torsion boxes a few weeks later.

Serious design work on the final project submitted to the Secrétariat Général à l'Aviation Civile et Commerciale for its "Moyen Courier" competition started in October 1952. By the following February the fuselage mock-up was under construction and metal was being cut for the first detail parts; the main structure was completed just over a year later. There is an order for two prototypes, and on the very same Saturday that the first fuselage left its jig, the second was laid down. The present schedule envisages the first machine being rolled out in March next year and the first flight in June, with the second example coming in August or September. With a continuation of present progress there should be no difficulty in achieving the target.

Mr. Pierre Satre, chief engineer of the Toulouse factories of the S.N.C.A. du Sud-Est, and his team have laid out the Caravelle from the start on a production basis. That is to say, all parts are designed to be easy to manufacture in quantity; but although jigging is fairly extensive for a prototype it is not elaborately expensive.

The fuselage is built on a skeleton, consisting of a series of closely spaced ring frames—some seventy in a length of one hundred feet—and skin panels with narrowly pitched longitudinal stringers. The closeness of the frames and stringers (there are 87 on the full diameter of ten feet) is intended to give the fuselage exceptional stiffness to resist both aerodynamic loads and the thrust from the turbojets at the rear. The greater part of the fuselage is cylindrical, with tapering portions at nose and tail, the former ending in a Comet cockpit (bought complete from de Havilland) and the latter containing the passenger entrance tunnel and an integral fin stub.

The cylindrical cabin is 51ft 8in long and is built with a level 9 g floor incorporating six extruded seat rails as structural members. With this arrangement the seats can be arranged in banks of two and three, either to port or starboard. The banks can be varied in pitch or folded up to the fuselage side, and the front bulkhead brought aft to increase the forward freight space. In the front port side of the fuselage is a freight door 6ft 6in × 5ft 11in, which opens upward hydraulically. It is so designed that upon pressurization the force on the hinges is tangential and not outward, so tending to keep the door closed.

The nose, tail and centre section of the fuselage are being made as complete units in jigs, but the greater part of the cylindrical length is being built in segments on two very simple jigs. These sections are afterwards assembled rapidly in the main jig. The method of making the skin panels is unusual: the lipped L-section longitudinal stringers are attached by spot welding, using Aero Research Araldite as an anti-corrosion agent and as a stabilizer for the thin (1 mm) sections.

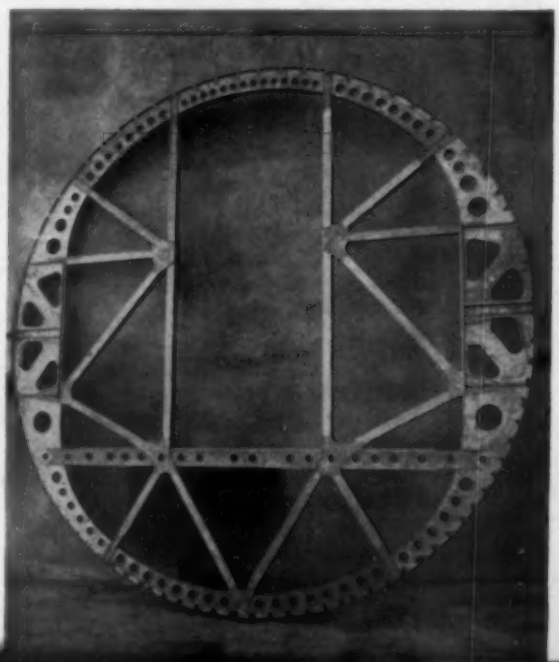
In the plane of the freight door, at the wing attachment, at the engine bay, and at the tailplane, reinforced frames are used to take the concentrated loads. These are box-section ring members for the most part, but in the engine bay they are braced by upright square tubes with Warren trussing from the sides. This gives the tail rigidity to resist engine thrust, and the structure so formed is used as the basis for vestibules and light-luggage racks.

The rear pressure-wall is flat, with a door in the middle leading to the skinned tunnel of the companionway. The hydraulically operated underhatch of the companionway forms both an integral stair and a ground tail support. Considerable thought has gone into the design of the companionway, which can be used as a crawlway after a belly landing, and has an emergency hand pump accessible both from inside and outside.

The wing is designed with a torsion box from 15 to 50 per cent chord, which also acts as an integral fuel tank. The box is made in two halves, joined, below the pressure fuselage, by ten bolted joints. Although the skin-stressed structure is made largely of Zicral (a zinc light alloy) in order to achieve a good strength/weight figure, all concentrated-stress fittings are of dural-type alloys so that fatigue replacements may be avoided.

Spar booms, skin stiffeners and most strip parts are extrusions of special section designed each for its own job. This has promoted structural efficiency, and the simpler handling (compared with rolled strip or adapted standard extrusions) in most cases has saved the die cost of 50,000 to 100,000 francs on the first prototype alone. Spot welding will be used for assembly of the wing-skin stringers on production, but for convenience the prototype has been riveted.

With the engines aft, the wing is completely "clean" and advan-



A typical braced frame in the engine bay of the fuselage.

The heading picture on the left, of the fuselage interior, shows the close pitch of the skin stiffeners, the perforated inner reinforcing skin round the windows, and the extruded seat rails which form the main longitudinal floor members.

Right, how the fuselage appeared when the wing torsion-box was assembled and the tailplane offered up temporarily. Note the triangular windows, the five starboard emergency exits and the detachable webs of the torsion-box.

tage of this has been taken to fit full-span leading-edge flaps and slotted extension flaps for the full distance between ailerons and fuselage. Leading-edge flaps, which give a marked rounding off to the top of the lift curve, were adopted as a result of their success on the Grognard. However, since the Caravelle cruises at a very moderate Mach number (.75), the aerofoil is 12 per cent thick and is not symmetrical, so there is now talk of saving weight, expense and complication by omitting the leading-edge flaps on production.

The undercarriage is being designed and built by Hispano Suiza and consists of a twin nosewheel unit, retracting forward, and four-wheel bogie main units, retracting inboard. The latter are mounted, fairly close to the fuselage, aft of the spar, so that the wheels lie inside the wing/fuselage juncture.

Following experience with the Grognard, very great care has gone into the design of the control system. The Grognard had duplicated power-control units (with the idling circuit following up at all times) and fully representative artificial feel. During test rig trials there was a jack failure, which was overcome by the follow-up circuit, with no more than an increase in stick load—but when the reserve was cut off the faulty circuit ran away. The feel in the Grognard controls enabled it to be flown easily by numerous pilots without previous dual, yet when the feel was experimentally cut out the pilot could scarcely control the aeroplane.

In view of this experience, M. Satre decided not only to follow the practice of the Grognard but even to increase the precautions in consideration of the Caravelle being a transport and not an attack fighter. A spring tensioner is being used to increase the control force with displacement, and H. M. Hobson feel units (as used on the Victor and the Britannia) are being incorporated to sense airspeed effect. In addition, there is to be a simple mass balance on the control column itself, which will pull it forward if the pilot attempts to apply too much g inadvertently.

When deciding upon ancillary equipment M. Satre was guided by reliability and availability, the idea being to select components with many thousands of hours of airline life and therefore both well proven and widely distributed. The result is a curiously polyglot equipment schedule. In addition to the furnished Comet cockpit, there is Flight Refuelling fuel equipment, Lockheed pumps and hydraulic units, Lockheed Servodynes for the controls, Rotax starting panel, Graviner fire protection, Kent flowmeters, Smiths fuel gauges, Dunlop wheels, tyres and brakes, and, of course, the Rolls-Royce Avon RA.16s, all coming from Great Britain. Electrics and radio are mainly American or French, and the cabin pressure regulator is by AiResearch. Instruments are chosen from French, British and American sources.

Although intended primarily for the Paris-North Africa traffic, which is highly seasonal, and means stages of about 1,000 miles, the Caravelle was not designed without consultation with many airlines both in Europe and the U.S.A. Its capacity has been designed to fit into stage lengths up to 1,500 nautical miles, and the high cruising speed of the turbojet is intended to offset its high fuel consumption by allowing much greater utilization than would be possible with a turboprop. The soundness of the S.N.C.A. du Sud-Est reasoning, which runs counter to most other authorities, can be proved only by practice. Flight trials in 1955 and 1956 will certainly be of the greatest interest in proving who is right.

J. H. S.

S.N.C.A.S.E. CARAVELLE

Dimensions		
Span		112ft 6in
Length		103ft 4in
Height		28ft 6in
Track		17ft 4in
Wing area		1,579 sq ft
Sweepback, 25 per cent chord		20 deg
Aspect ratio		8.02
Dihedral		3 deg
Incidence		2 deg
Weights:	**Two Avons 10,000 lb s.t.**	**Two Avons 11,000 lb s.t.**
Tare	42,030 lb	42,250 lb
Empty, equipped	42,880 lb	43,100 lb
Max. take-off (structure)	99,200 lb	
Max. landing (structure)	79,350 lb	
Zero fuel (20,900 lb payload)	64,000 lb	
Max. take-off, I.S.A.	97,000 lb	107,300 lb
Take-off, I.S.A. (5,900ft runway)	88,150 lb	93,250 lb
Payload, max.	20,900 lb	
Performance:		
Cruising speed	415 kt at 37,000-44,000ft	428 kt at 35,000-48,000ft

Note.—With 20,000 lb thrust, cruise starts at 400 kt at 28,000ft, then rises gradually to 415 kt when weight has fallen to 78,000 lb. With 22,000 lb thrust the cruising speed is constant. Max. altitude occurs only in long-range condition with weight down to 53,000 lb.

Ranges, I.S.A. conditions: (Reserves = 12 per cent + 160 nm to alternative + ½ hr stack at 5,000ft.)		
With 15,400 lb payload	1,750 nm	2,200 nm
With 20,900 lb payload	1,280 nm	1,720 nm
Max. range (6,600 lb payload)	2,675 nm	—
Max. range (11,000 lb payload)	—	2,625 nm

FORTHCOMING EVENTS

Sept. 25. Low-Speed Aerodynamics Research Association: Conference on model aerodynamics (at 4, Hamilton Place, London, W.1.)
Sept. 25-26. Aero Club of Germany: Hanseatenflug international rally.
Sept. 26. St. Albans M.Ae.C.: All-Britain Model Aircraft Rally, Radlett Aerodrome.
Sept. 20-29. Fédération Aéronautique Internationale: 47th annual general conference, Istanbul.
Sept. 29. British Institution of Radio Engineers: "Computing Circuits in Flight Simulators," by A. E. Cutler, B.Sc., Ph.D.
Sept. 30. R.Ae.S. Graduates' and Students' Section: "Air-to-air Photography," by Russell Adams.
Oct. 2. S.L.A.E. S.E. Area: "Sperry Gyroscopic Instruments." by P. Hobley, M.I.N., C.S.L.A.E.
Oct. 11. Institute of Transport: Presidential address by Sir Gilmour Jenkins, K.C.B., K.B.E., M.C., M.Inst.T.
Oct. 12. R.Ae.S. Section Lecture: "Behaviour of Light Alloys at Elevated Temperatures," by B. C. Gadd.
Oct. 13. Radar Association: "The Decca Navigator," by G/C. E. Fennessey, O.B.E., and H. G. Hawker.
Oct. 15. Rochester Flying Club: Annual dinner and dance, Bearsted.
Oct. 15. Helicopter Association: "Application of Gas Turbines to Helicopter Propulsion," by J. Brown.
Oct 15. The Airlines Ball, Royal Albert Hall, London, 8 p.m.-2 a.m.
Oct. 19. R.Ae.S. Graduates' and Students' Section: "The Propeller-Turbine in Airline Service," by T. M. Corson.
Oct. 21. R.Ae.S. Main Lecture: "The Development of Reheat," by J. L. Edwards.
Oct. 26. Institute of Transport: Visual aids meeting: films on air transport.
Oct. 27. Institute of Welding: Annual dinner.
Oct. 28-29. Institute of Welding: Presidential address by Mr. R. G. Braithwaite, M.I.C.E., and discussions on papers dealing with welding and materials.
Nov. 10. Institute of Transport: Anniversary luncheon.

HERE AND THERE

Supersonic Order

THE placing of an order for F-100 Super Sabres, to the value of over $100m (£35¼m), was announced by the U.S.A.F. last week-end.

The Hainan DC-4 Incident

BRITAIN is claiming £367,000 compensation from the Chinese Government for the DC-4 of Cathay Pacific Airways which was shot down off Hainan Island on July 23rd. Ten lives were lost.

Sea Hawk Record Confirmed

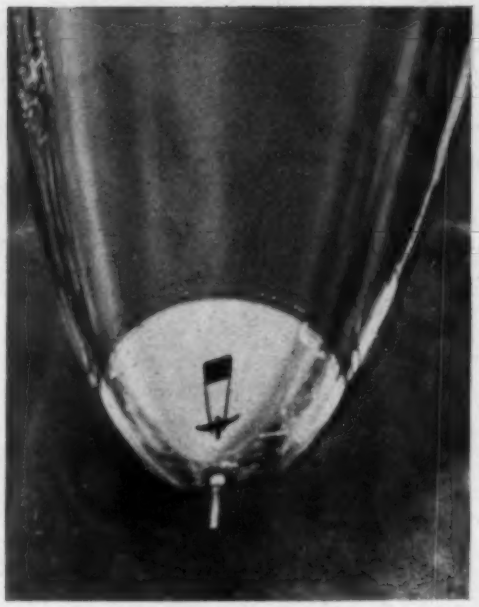
THE London to Amsterdam record set up on July 29th by Lt. J. R. F. Overbury, R.N., in a Hawker Sea Hawk F.B.3 (Rolls-Royce Nene) has been confirmed by the F.A.I. Average speed was 919.760 km/hr (571.5 m.p.h.).

Hawker Siddeley in Scotland

THE Hawker Siddeley Group has acquired its first subsidiary in Scotland—the Kelvin Construction Co., Ltd., of Lochburn Road, Glasgow. It is reported that there will be no change in the management and that none of the 500 workers will be affected; the firm is engaged in heavy constructional engineering. Sir Frank Spriggs becomes chairman of the company and Mr. Harold Jacobson remains the managing director.

Reefer

THE pilot of Fiji Airways D.H. Drover VQ-FAO recently made a forced landing on a coral reef. The aircraft ran safely along the coral for some 200 yards before one wheel struck a soft patch, as a result of which the starboard wing and undercarriage were damaged. The pilot, Capt. F. Ladd, and all seven passengers escaped with a shaking. The aircraft was eventually salvaged after being completely submerged by three high tides.



I SEE A DARK STRANGER . . .: The "crystal ball" is the transparent nose cap of the prototype English Electric Canberra B.8 night intruder; the image therein is that of a U.S.A.F. Fairchild C-119 Packet, from which this "Flight" picture—here much enlarged—was secured.

Making a Splash

IN order to trace the migratory habits of buffalo, zoologists in Wood Buffalo Park, 400 miles north of Edmonton, Alberta, are employing helicopters in a novel manner. The aircraft descends low over the herds and the crews "brand" the animals by means of paint squirted from a gun.

Concrete Example

AN R.A.F. Sunderland which sank after striking a rock near the harbour of St. Peter Port, Guernsey, on Wednesday of last week, was successfully refloated after nearly three tons of quick-drying cement had been poured into the bilges.

M.T.C.A. Appointment

THE Minister of Transport and Civil Aviation announces that Mr. R. G. S. Hoare, M.V.O., M.B.E., has been appointed their chief information officer with effect from September 6th. He will be assisted in matters affecting civil aviation by Mr. V. Alford.

Models at Radlett

RADLETT airfield has been placed by Sir Frederick Handley Page at the disposal of the St. Albans Model Aero Club for their All Britain Rally next Sunday, September 26th. Admission is by programme, price 1s, obtainable at the gate; car parking is free. Flying begins at 10 a.m.

Saab's Year

THE Swedish Saab company reports a net profit of 7,980,000kr. (£550,000) for the year ended June, 1954.

The Old, Old Outcry

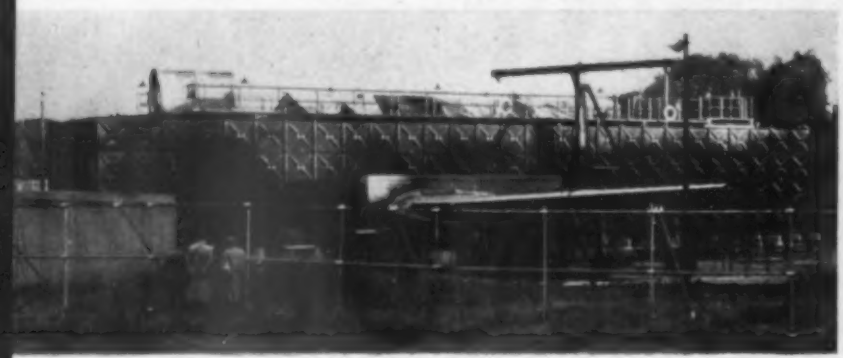
INCREASING use of Croydon Airport by flying clubs has led a committee representing local residents to approach the Minister of Civil Aviation, asking him to take "immediate steps" to control their activities. The residents allege that the small aircraft are "both a nuisance and a potential danger."

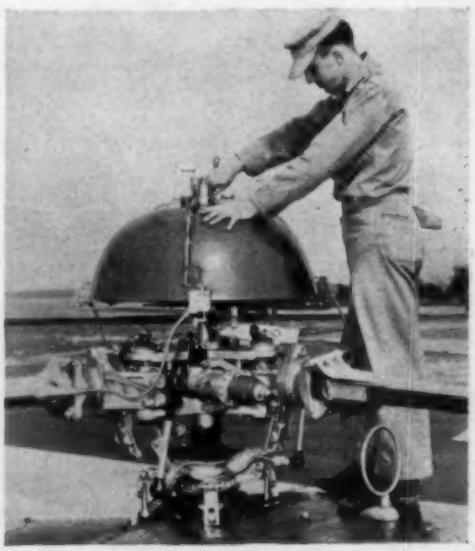
Vickers in Australia

FOLLOWING publication of our Commonwealth Aircraft Industries Number (August 27th), we are now informed that a company known as Vickers-Armstrongs (Australia) Pty., Ltd., was formed on January 1st, 1954. It is concerned with development work on guided weapons in South Australia, and is also to provide after-sales service for Viscount operators.

TIP BOOST: Rocket-assisted blades are reported to have given a valuable increase in lift when applied—as described on page 500—to the rotor of a U.S. Marine Corps HRS-2 helicopter. In the view on the right is the dome-shaped tank which, mounted above the rotor head, contains enough hydrogen peroxide fuel for 20-25 take-offs.

SEEN AT FARNBOROUGH by thousands of visitors to the S.B.A.C. Show, this unusual test-rig consists of a large tank with Comet wings emerging from glands on either side. Primary purpose of this realistic test is to investigate possibilities of pressure fatigue in the hull, with flight loads simultaneously applied to the wings.





CONTRACTING BY HELICOPTER

Rotating-wing Aircraft in Diverse Employment: Mr. Knute Flint's Lecture

In forest-fire and power-line patrols, in particular, precarious landing-places such as this are familiar to the helicopter pilot. This Bell was photographed in the Sierra Mountains of California, at a pressure altitude of 8,000ft.

THE privilege of presenting the first paper to open the 1954-55 lecture programme of the Helicopter Association of Great Britain fell this year to Mr. Knute W. Flint of Bahamas Helicopters, Ltd. The meeting was held at the Dorchester Hotel on September 9th and was followed by the Association's annual dinner, a report of which appeared in last week's issue of *Flight*.

Introducing the lecturer, Mr. Eric Mensforth, president of the Association, said that Mr. Flint was among the most experienced helicopter pilots in the world. At the age of 33 years he had already completed over 2,500 flying hours, mainly on rotating-wing aircraft. He had commanded the first U.S.A.A.F. Helicopter Rescue Squadron, operating in Burma in 1944. In 1946, he had formed a helicopter operating company, in association with Mr. H. B. Armstrong, with its headquarters in Burbank, Los Angeles. Since that time the company had undertaken, and successfully carried out, almost all the tasks of which the helicopter was capable, in almost all parts of the world.

Mr. Flint began by outlining briefly the history of helicopter work. Civil operations had begun shortly after the Bell Aircraft Corporation had succeeded in obtaining the first American civil helicopter certification, in 1946. Mr. Armstrong and he had started their company at that time and had successfully continued operations for eight years. In the early years the helicopter operators were presented with a wide variety of tasks, from killing basking sharks to delivering Santa Clauses in disillusioning numbers at Christmas time.

Gradually the unimportant fields of operation were eliminated until, at the present time, there remained only a few by comparison. In the lecturer's view, a field of operation was important only if three or more operators flew, annually, more than 500 hours on that particular work. This was a modest demand by fixed-wing standards but it eliminated a surprising number of spheres of employment.

In public helicopter operations, there were, at present, only two important rôles for the helicopter—mail delivery and passenger transportation. These would, he thought, undoubtedly increase in importance. In the future, other important public operations would include police patrol, which was already being carried out experimentally on a small scale, border patrol and ice-breaking reconnaissance. The last-mentioned had also been started already: by the Danes in Greenland and by the Canadians and Americans in their respective commercial waters. In addition, general rescue work (as opposed to military rescue operations) would become an important rôle for helicopters operated by military and quasi-military organizations.

So far as the private operators were concerned, six important fields presented themselves:—

(*1*) *Oil Search.* Here the helicopter provided transportation for men and materials in areas difficult of access. The work started in the Mississippi delta; today both gravimeter and seismic surveys were being conducted by helicopters in swamp, desert and jungles all over the world. Each type of area required a special technique. In swamp, there were no real clearance problems, though tail-rotor abrasion was high because of long grass. In desert, the problem was heat and sand abrasion of engines and main rotor blades, which proved costly to the operator. In jungle, the cutting of clearings and flying out of them with heavy loads was the greatest difficulty. The helicopter was now a recognized tool in oil-searching projects and would certainly be used to an even greater extent in the future.

(*2*) *Mapping.* For the previous few years there had been more than 25 private helicopters operating on mapping contracts in Alaska alone. Similar work had been done in Greenland and South America. The increase of speed in doing the work with the aid of the helicopter bordered on the fantastic. Records were commonplace of three men doing in two weeks the work that previously required twenty men three years to complete.

(*3*) *Agricultural Aids.* Crop-dusting and spraying were among the first uses of the helicopter in this sphere, and these tasks they performed most effectively. In general practice, however, the helicopter's unique advantages were overshadowed by the much lower operating cost of fixed-wing aircraft. While the helicopter was now firmly established on the list of tools employed by farmers, its use was small by comparison with the use of aero-

A typical landing platform in a jungle clearing in New Guinea. The rubberized-canvas pontoons are equally at home on land or water. Wind direction is usually ignored for the take-off.

After Mr. Knute Flint's lecture, the Helicopter Association held its annual dinner. In this group (reading clockwise from extreme left) are:— Dr. G. S. Hislop, of Faireys; Sir Arnold Hall, Royal Aircraft Establishment; Mr. G. W. Hall, Faireys; Lady Hall; Mr. N. E. Rowe, Blackburn and General Aircraft; Mrs. Vines; Mr. Alan Vines, Faireys; the Editor of *Flight*; Mrs. McDonald (wife of A. Cdre. A. W. B. McDonald); and Maj. C. H. Chichester Smith, Faireys.

CONTRACTING BY HELICOPTER . . .

planes. Even in California, where there were more private helicopters employed in agriculture than the total so used by the rest of the world, they treated less than 20 per cent of the acreage treated by fixed-wing machines. The helicopter would not compete seriously with the aeroplane in the agricultural field until there was available on the market a helicopter selling for less than £2,500 and with a payload of at least 500 lb.

(*4*) *Power-line Patrol.* This was a job which called for a high degree of skill on the part of the pilot. In mountainous country, following a power line down the side of a steep canyon could be a difficult feat in the severe turbulence and tremendous up-currents which were sometimes experienced. The work could be done much more efficiently, though, with a helicopter than by ground parties.

(*5*) *Forest Fire-fighting.* Here again, the work could be done more efficiently with a helicopter than by either ground parties or by fixed-wing aircraft. On one occasion the lecturer's helicopters had flown 200 men from a valley floor to a ridge up which a fire was racing, in 3½-minute round trips. To reach the position would otherwise have required 90 minutes of laborious climbing. Such flying involved no little hazard, but the results could be achieved in no other way.

(*6*) *Training.* Although more training was being done by the military establishments than by private operators, this work certainly qualified for inclusion among the important fields of helicopter operations.

The lecturer then went on to discuss the future possibilities for private helicopter operators. Passenger transportation would be an important field of operation for the private operator, he thought, in addition to public corporations. Private competition was, in his opinion, the best incentive to improving service and reducing costs. Whale spotting and freight carriage would also become important.

Mr. Flint had a number of interesting comments to make on the most suitable type of helicopter for the commercial operator, and on the best methods for reducing operating costs. He favoured the single-rotor machine, if only for the reason that blade replacement was the largest single item in an operator's maintenance costs and the fewer the blades the less was the cost of replacement.

Insurance was another expensive item. Because of the high insurance rates, his company had adopted the procedure of carrying their own insurance and rebuilding their own machines in the event of an accident. They had found that, with skilled maintenance personnel, the average cost of rebuilding was equivalent to a 10 per cent insurance premium, whereas the actual premium would be nearer to 20 per cent. The excessive first capital cost of new machines had an important influence on keeping operating costs high and if a cheap helicopter could be available at a cost of no more than £2,500 it would be in considerable demand.

Utilization was a most important factor. In New Guinea they had two helicopters flying on an oil survey contract, with a third machine as stand-by. With this three-machine combination they were averaging almost 1,000 hours annually per helicopter, including the stand-by machine. This was by no means the limit. Should there be the demand for the flying, a utilization of from 2,000 to 4,000 hours annually could be achieved in favourable circumstances by a well-tried helicopter such as the Bell, Sikorsky or Hiller. To achieve such high utilization, maintenance had to be carried out on the unit-replacement principle. For their operations in New Guinea, the stock of spares to "back-up" the three helicopters included a complete "power-pack" (i.e., all the moving parts of the helicopter assembled into one unit), four spare engines, small spares to cover a year's flying and a fourth helicopter broken down into units such as the tail boom, main frame, undercarriage, cockpit and nose section, and the plastic bubble. This fourth machine was held to ensure a rapid re-build in the event of a major accident.

Mr. Flint then showed an excellent colour film to the meeting, portraying his company's operational methods in the New Guinea jungles, and his commentary was most illuminating. He explained that, when undertaking a contract in such terrain, the helicopter operator had to assume the entire responsibility for the penetration and provision of clearings required. His company had trained a crew of 20 natives with three supervisors and they were engaged solely on this task. Using portable power-driven chain saws, the crew could cut a clearing of 60 yards by 100 yards in a day and build a rudimentary landing platform for the helicopter on top of the resultant jumble.

Film sequences from the air showed clearly the chain of clearings (spaced approximately two miles apart) which they had provided to ensure the helicopters' safety. On their sorties into the heart of the jungle, carrying geologists or equipment in connection with the oil survey, the machines flew at a height of between 1,500 and 2,000ft over the forest. By adopting this procedure, they were always within gliding distance of a clearing should an emergency landing become necessary. Their pilots almost invariably made precision autorotative landings, even at the base camp, in order to keep in constant practice.

Other film sequences demonstrated the technique employed in taking off and climbing away from a clearing. The trees were, on an average, 150ft in height. While flying within the limits of the clearing, below the level of the tree-tops, and to gain height at the best climbing speed of 45/50 m.p.h., all turns were made to the right. This precaution ensured that in the unlikely but nevertheless possible event of tail-rotor failure the resulting swing to the right would automatically turn the helicopter in towards the centre of the clearing and away from the forest. A swing caused by power failure could be controlled by the rudder pedals. These precautions, though not often needed in practice, were a necessary part of the operation. If a forced landing did occur and repairs or replacement of parts was required, the maintenance personnel and equipment were flown into the clearing in another helicopter. The servicing was then carried out on the spot.

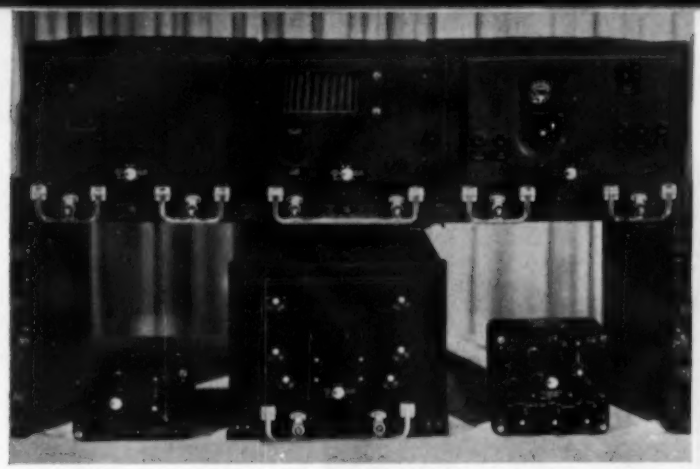
Skids or pontoons were equally satisfactory forms of landing gear. In New Guinea they were operating two machines with skids, and one on pontoons which could also be used for river landings. The passengers were carried in the cabin, but equipment for transportation was strapped on to two platforms specially fitted above the landing gear. An average load under these difficult conditions was in the region of 400 lb; but by operating a rapid shuttle service with the helicopters, many thousands of pounds of equipment had been moved into the jungle in an extremely short space of time.

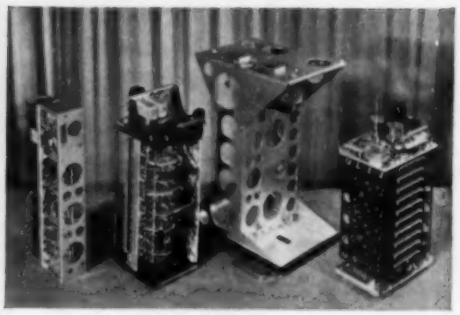
When weights had to be lifted which were too heavy for the helicopters in use, road-building machinery such as bulldozers could be dismantled and flown in by helicopter to a clearing cut at the desired location. With this machinery an airstrip could then be constructed to allow freighters to bring in the heavy loads.

AIRCRAFT FOR BUSINESS

IN a recent leading article we touched on the advantages of aircraft ownership for business houses, and now we find our views supported by a firm on the South Coast—the Longford Engineering Co., of Bognor Regis, who operate a Messenger and an Auster, flying them from their privately owned grass airfield adjoining the factory. Two pilots are employed as "flying salesmen" to handle the company's home and export refrigerator trade. The company's overseas representative, Mr. George Farley, who has flown the aircraft in South Coast air races, recently left on a two-week goodwill tour of Italy, Greece and Cyprus in the Auster.

Mr. Charles Purley, Longford Engineering's managing director, decided to employ executive aircraft as soon as civil flying restrictions were lifted after the war. He found they were as economical as 16 h.p. chauffeur-driven cars and, from the company's point of view, faster and more convenient than scheduled air and sea services to the Continent. Representatives reach Paris, for example, in about 1 hr 40 min from Bognor Regis. It would take them considerably longer to travel by train to London, and thence to the Airport, in order to travel there by airliner.





Marconi multi-channel high-power transmitter/receiver Type AD.307. Top row, l. to r.: Drive and receiver unit Type 2500, power amplifier unit Type 2502, modulator and power unit Type 2510. Bottom row, l. to r.: remote-control unit Type 2508, aerial tuning unit Type 2509. The second illustration shows the sub-units of the drive and receiver unit removed for inspection.

AIRBORNE RADIO AND NAVAIDS

—*at the Farnborough Show: New Equipment Designed for Overseas Service*

BOTH this article and the one which immediately follows it are the work of writers who are professional users of aircraft radio equipment, and their notes on the radio and navigation aids exhibited at the Farnborough Show are from the critical standpoint thus implied. The first article deals principally with airborne equipment; the second, beginning on page 480, is concerned primarily with ground equipment, and also includes some notes on the closely associated subject of airport lighting.

FARNBOROUGH 1954 has been a "vintage" year for airline communications engineers because it has not only revealed new developments and products in every section of the aeronautical radio communications and navigational field but it has provided definite evidence of a change in the British aircraft radio industry's outlook: design is now being conducted with international markets in mind and not just to meet British operators' requirements, as has appeared to have been the case in previous years. Over the past few years, many airlines and operators purchasing British aircraft radio have felt that, although this equipment met the requirements of British operators with regard to their own domestic and European services, it sometimes fell short on certain operational and maintenance standards considered mandatory by overseas airlines and operators; these customers, therefore, could have their requirements met only by buying from outside the British industry.

This situation is, however, now completely changed; and at this year's Show a wide variety of equipments were on view which were not only designed to provide facilities equal to those of overseas products, but which would in many cases give greater flexibility and meet wider requirements than would any other equipment available anywhere.

The design features which generally offered most appeal were as follows: (1) A general move to sectionalized unit or plug-in assembly construction, with its resultant ease of maintenance and spares economy. (2) Generally cleaner layout design, wiring, and component mounting, with careful study given to ease of component replacement. (3) An improvement in control-unit design and a general move towards engineering control facilities so that an operator can have various radio equipment controls combined on one central panel for ease of servicing. This has proved to be a desirable feature in the planning of new aircraft flight-deck layouts, due to growing instrumentation needs in other directions. (4) Widespread recognition of the use of "reliable" or "special quality" valves as being a mandatory requirement.

H.F. COMMUNICATIONS. In the H.F. communications field, *Marconi's Wireless Telegraph Co., Ltd.*, showed for the first time their AD.307 crystal-controlled 200-channel 130-watt transmitter/receiver, which they have especially designed to meet the world requirements of long-range, pilot-operated radio telephony. The 200 channels are available between 2 and 24 mc/s, their distribution being 50 between 2 and 3.72 mc/s, 80 between 3.72 and 6.92 mc/s, 50 between 6.92 and 12.9 mc/s, and the remaining 20 between 12.9 and 24 mc/s.

Frequency stability is stated to be better than plus or minus 0.02 per cent and channel changing is entirely automatic, with self-tuning circuits. High-level modulation to 100 per cent is obtainable from any type of microphone, magnetic or carbon, and all valves used are directly replaceable by equivalents in the American ARINC range.

The total weight of the equipment is given as 116 lb and, with the remote control provided, the possibility of locating the equipment anywhere in the aircraft, and the ability to mount the antenna tuning unit remotely and feed it *via* a co-axial cable, the AD.807 is a set which will meet an international operator's requirements for many years to come.

Marconi have also allowed for future foreseeable trends by making provision for CODAN (carrier-operated device anti-noise) and also for operation with an alternative drive and receiver which will give 44,000 discrete transmitting and receiving channels.

Standard Telephones and Cables, Ltd., also showed their new STR.18C 100-channel 100-watt H.F. transmitter/receiver, which is now in large quantity production for installation in the Bristol Britannia, together with many other aircraft. A new military version of this equipment designated the STR.18B2 was also on display. This equipment is specially designed for pilot operation in that, whilst the remote control is as fully flexible as before, direct controls have been removed from the unit to simplify field maintenance.

V.H.F. COMMUNICATIONS. In the V.H.F. communications sphere, *Standard Telephones* took the wraps off their new V.H.F. R/T. transmitter/receiver, the STR.20, and this equipment from the first day became the centre of attraction on the company's stand. The design of this equipment is a real eye-opener; and, whilst it has been designed primarily for military use, it also has distinct possibilities for future civil employment.

The STR.20 provides 560 channels with 100 kc separation between 100 and 156 mc/s, or 623 channels with 90 kc separation in the same band. Of these channels, 20 are available in flight by operation of a simple rotary switch, which can be built

Standard Telephones and Cables' new STR.20 V.H.F. transmitter/receiver giving 560 channels, with 100 kc/s separation, between 100 and 156 mc/s. Left, channel selector unit; centre, transmitter/receiver and frequency-selector units; right, pilot's controller.

Ferranti 1,000 mc/s D.M.E. controller. The two lower knobs, interlocked, permit selection of up to 99 channels. (Right) the 3¼in presentation, showing exponential scale (0-200 miles), left/right homing indicator, and operational warning flag.

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into a central radio panel, the 20 channels being pre-selected by a small plug-and-socket selector board, in appearance not unlike a miniature telephone switchboard.

Frequency control of this multi-channel equipment is effected by a frequency synthesis system using a small number of crystals; on selection of the required channel, tuning is entirely automatic. In addition to the frequency selected, a pre-tuned guard channel can also be simultaneously monitored in the receiver.

Power output is rated at 5 - 10 watts and the total equipment weight is 63.75 lb.

The STR.20 which is now in production, is stated by Standards to be their successor to the well-known STR.9X equipment; and when it is realized that over 20,000 of the earlier sets are in service (and that the STR.12D is fitted in Viscount, Comet, Britannia and other aircraft) an appreciation can be gained of this company's experience in the V.H.F. airborne equipment field.

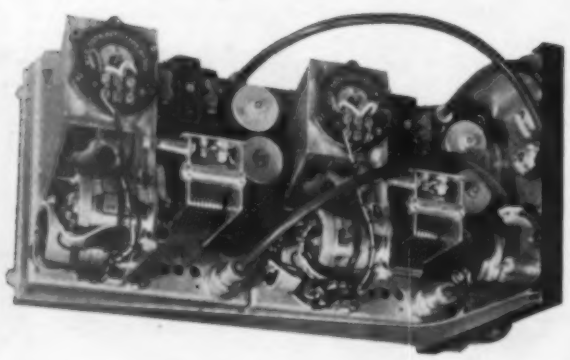
V.O.R. (V.H.F. OMNI-RANGE) NAVIGATION. In this field, *Standard Telephones* showed their Type SR.31 V.O.R. receiver, which is now in quantity production and has been installed in B.O.A.C. aircraft. It operates in conjunction with omni-range beacons which are used as the standard short-range navigational aid throughout the U.S.A. and are now being installed throughout the world.

The visual presentation of the SR.31 is unique in that one 3½in panel-mounted instrument supplies continuous indication of the aircraft bearing, together with mechanical selection of the track to be flown. Output from the SR.31 also operates the vertical needle of the I.L.S. cross-pointer indicator, thus providing left/right information for track flying.

S.T.C. also supply a compass amplifier which will repeat the magnetic-compass information so that the SR.31 will operate with a radio-magnetic amplifier.

The construction and design elicited many favourable comments; it gave evidence of this company's policy of using plug-in assembly construction—a feature of great appeal to the airline communications engineer.

New Marconi Type 1864 tunable dual-sense amplifier for use with Type AD.7092C auto direction-finder in areas of high-level unwanted signals. (Left) Type AD.127A controller for the A.D.F. Note the use of rear lighting and clear designation of functions.



D.M.E. (DISTANCE-MEASURING EQUIPMENT). When considering V.O.R., it is essential jointly to consider D.M.E. also; and a noteworthy feature of the Show was the display of D.M.E. models from four different firms—Ferranti, Murphy, Amalgamated Wireless (Australasia), and Pye.

Ferranti showed for the first time their new streamlined 1,000 mc/s D.M.E. airborne interrogator Mk II, and a very interesting development it is. The set has been completely re-designed to meet the I.C.A.O. specification and the whole installation now consists of four main components: the main unit (transmitter, timing system, and receiver), 12in × 8in × 12½in; the control unit, 6in × 6in × 4in; an exceptionally interesting "shark-fin" antenna of 2½in height; and a standard 3½in instrument giving range presentation of 0-200 miles on one exponential 270-deg scale, together with operating flag and homing presentation.

Total weight appears to be about 60 lb. Transmitter power output from the G.E.C. disc-seal triode type CV 2201 is 4 kW and the measuring accuracy claimed is plus or minus 3 per cent, or half a mile. So that this equipment can be used to the fullest in areas where V.O.R. is not available, Ferranti have engineered a homing facility which can be incorporated in the unit if the customer requires it. The Ferranti D.M.E. is another British equipment in which full use is made of sub-assembly techniques.

Amalgamated Wireless (Australasia) again showed their VAN-3 200 mc/s double-pulse D.M.E., which is now in full use by all Australian domestic airlines and also by Qantas on the Australia-Cocos Island-Johannesburg service.

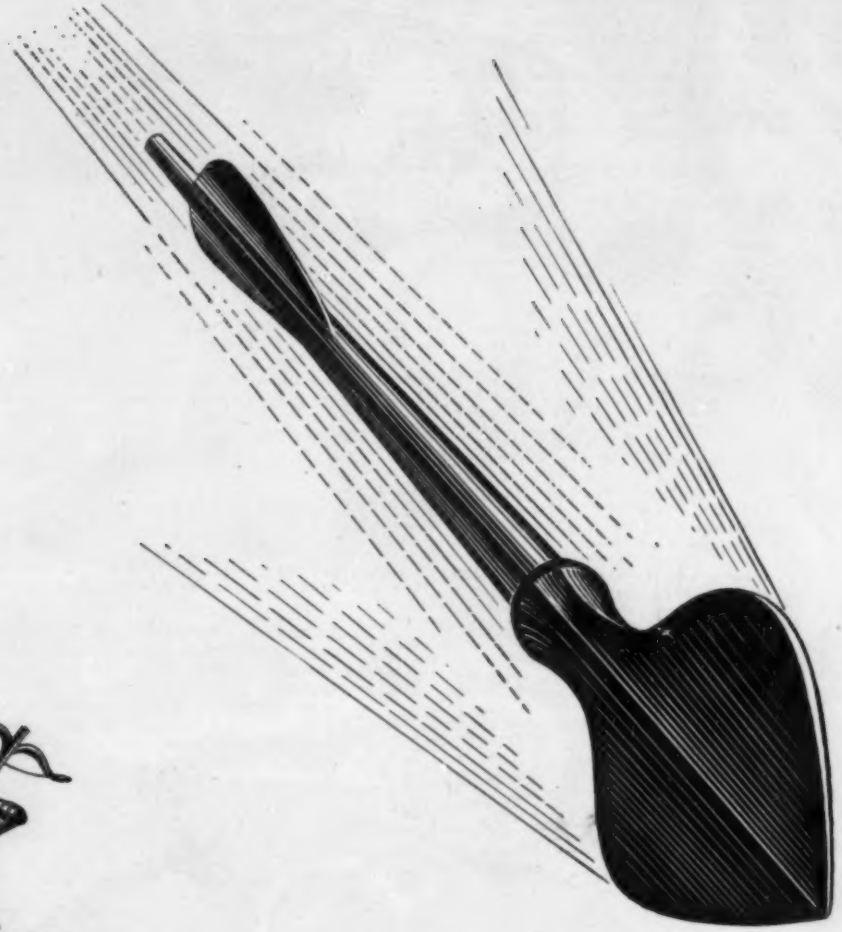
Pye Telecommunications also had on show a complete set of American Hazeltine Model 1800 1,000 mc/s D.M.E., which will be manufactured in England under licence by Pye, Ltd. The units on show were the transmitter/receiver, which is contained in a half-A.T.R. case, the control unit, and the indicator. Two ranges are covered, 0-40 and 0-200 miles. As the equipment had arrived late from U.S.A., no technical details were available.

Murphy Radio again showed their Type 200 single-pulse D.M.E., which is now in general airline use on routes to South Africa and the Far East.

Both the Murphy and the Amalgamated Wireless D.M.E. equipments were used in the England to New Zealand Air Race and proved beyond doubt the value of this aid in long-distance jet flying operations.

AUTOMATIC RADIO COMPASS. *Marconi's* again showed their intention of furthering developments in this field by displaying their new model AD.7092C automatic direction-finder. It has been primarily engineered to meet the requirements of American operators, a move which can be taken as an excellent example of the British industry's desire to satisfy overseas requirements.

Development of this model was originally undertaken to meet the requirements of Trans-Canada Airlines for an A.D.F. for their Viscounts, and it has been so successful that other large overseas orders will doubtless result. The main changes between the AD.7092C and the other models are the re-valving of the receiver to accept ARINC Reliable tubes, a controller re-worked to overseas standards and layout, a new remotely tuned sense amplifier



HIGH AERODYNAMIC EFFICIENCY

The Eland is an aero-engine giving high power at low cost. It is a single-shaft propeller-turbine developing 3,000 e.h.p. at take-off, with a diameter of only 36 inches. This compactness makes for high aerodynamic efficiency. Other notable features include smooth, surge-free acceleration, low specific weight and low fuel consumption. All in all, the Eland is an impressive example of design and manufacture at the service of commercial aviation.

NAPIER Eland

D. NAPIER & SON LIMITED · LONDON, W.3.

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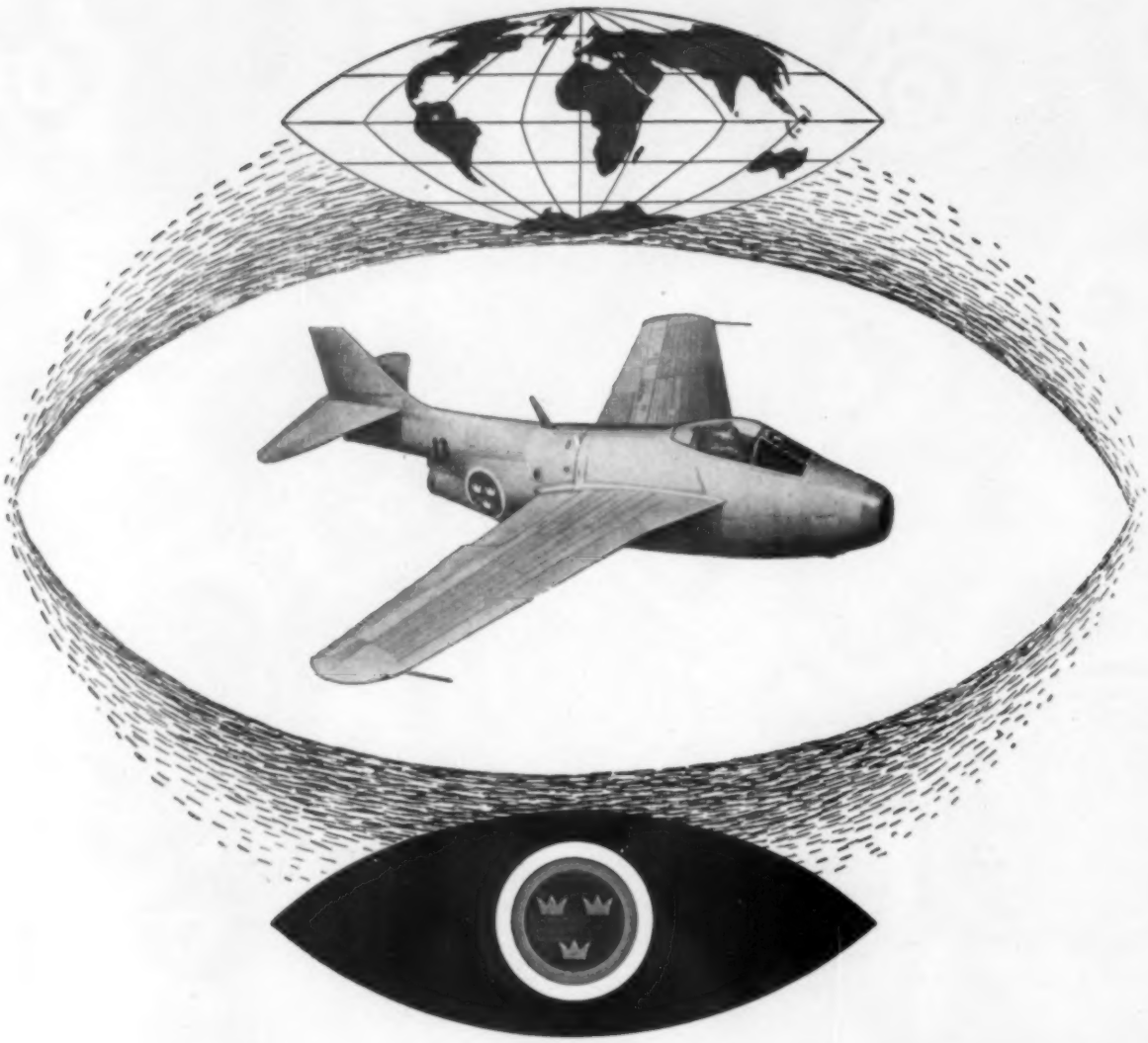

"Den flygande tunnan" använder Nimonic—legeringar

Saab J 29, med smeknamnet "Den flygande tunnan" var det första väst-europeiska jaktplan med pilformade vingar, som tillverkades i stor skala.

J 29 har en toppfart överstigande 1.050 km i timmen. Det är utrustat med en av Svenska Flygmotor AB licensbyggd D.H. Ghost reamotor med en dragkraft av 2.300 kg.

J 29: ans reamotor är—liksom fallet är med dess engelska motsvarighet - tillverkad av Nimonic-legeringar för att motverka krypning, utmattning och oxidering vid höga temperaturer. Turbinbladen äro tillverkade av Nimonic 90, statorbladen av Nimonic 80 och 80A och förbränningskamrarna av Nimonic 75.

Nimonic-legeringar används i alla brittiska gasturbiner.

As in all British aircraft gas turbines, NIMONIC* ALLOYS are employed for the rotor and stator blades and combustion chambers of the SAAB J.29's Swedish-built 'Ghost' engine.

**Nimonic is a registered Trade Mark.*

HENRY WIGGIN & COMPANY LIMITED · WIGGIN STREET, BIRMINGHAM 16

16/wt/79

Voltage standing-wave ratio detector by Amalgamated Wireless (Australasia). It is capable of measuring V.S.W.R. of aircraft aerials and feeder systems for practically every currently used aircraft radio installation in the 75 to 332 mc/s band.

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which gives improved selectivity in regions of high unwanted signal-strength (such as the New York area), and availability of a 600-ohm output.

Sub-assembly construction is also evident in this receiver and the interest shown by overseas airlines representatives must have been re-assuring to Marconi.

INTERCOMMUNICATIONS EQUIPMENT. *Mullard*, whilst not in the aircraft equipment manufacturing business, have given an incentive to British aircraft radio manufacturers by demonstrating the practicability of building an intercommunication system using transistor amplifiers, with a consequent large reduction in aircraft equipment weight.

Two two-stage transistorized amplifiers, using handsets with Lustraphone noise-cancelling microphones, were wired together for demonstration; and, even with the Olympus Canberra boring its way upwards directionally overhead, complete clarity of speech at a good high level was obtained. The two-stage amplifier using two Type OC 71 transistors, with mercury cell power supply, was quoted as having a power gain of 10^4.

This demonstration, one feels, should arouse interest sufficient to get some manufacturer to pursue the use of the transistor in reducing the weight of airborne intercommunication equipment.

Ultra Electric again showed their communication control system, with the addition of a speaker unit which can replace telephones.

AIRBORNE SEARCH RADAR. *Ekco Electronics* devoted their whole stand to an interesting display of their airborne search radar, Model E38B. It was mounted in a plastic aircraft radome which was gyrated vertically and horizontally—the relative movement being shown on a small aircraft model mounted above the display. The scanning unit installed was the Model E31B which has been designed for aircraft with limited nose-space.

AIR/SEA RESCUE EQUIPMENT. The firm of *Burndept* showed their air/sea rescue Model BE226 TALBE (talk-and-listen beacon). This is an extremely compact unit comprising a V.H.F. beacon and R/T. transmitter/receiver, with a collapsible metal-tape aerial. It is normally stowed on a Mae West, and the pilot can put it into operation immediately after ditching. It transmits a modulated c.w. signal on 121.5 mc/s, with a transmission range of 60 miles at a search height of 5,000ft. After location, it can be used for two-way R/T. over a range of 20 miles.

The total weight is about 3½ lb and it would appear to be a worthy addition to a civil airliner's dinghy kit.

Ultra had on display their air-sea-rescue system SARAH (search and rescue and homing). This equipment consists of two sections, one an extremely small pilot-carried beacon transmitter which transmits U.H.F. pulses for homing and then receives and transmits speech after location, and the other a small sub-miniaturized aircraft search set with a cathode-ray-tube presentation. The system can locate and identify a beacon operator with a high degree of accuracy.

The pilot-borne beacon unit weighs 3½ lb and the search unit approximately 12 lb. This equipment is in full quantity production for the R.A.F. and has been accepted for use by some NATO countries.

ANCILLARY EQUIPMENT. Of the smaller items on the various stands, the several new points are worthy of mention.

Two new items of test equipment by *Amalgamated Wireless* were their Model M54433 LO-Ohmeter for checking aircraft bonding, and a voltage standing-wave ratio detector. The latter unit is stated to indicate V.S.W.R. with an accuracy of plus or minus 20 per cent at frequencies of 75 mc/s, 100-150 mc/s, 206 mc/s, and 332 mc/s, thus covering antenna measurements for all generally used V.H.F. equipments.

A new V.H.F. antenna for helicopters by *Standard Telephones*, consists of a vertical stub mast with a horizontal top loading element, and it has a standing-wave ratio of better than 1.15 to 1.

OTHER EXHIBITS

In addition to the various equipments and details reviewed above, there were a number of other items of interest which can best be reviewed as stand-to-stand notes.

Burndept showed their Model BE219 single-channel V.H.F. transmitter/receiver, a neat unit with a total weight of 9 lb, and their BE227 V.H.F. transmitter/receiver which, specially designed for small trainer aircraft, also provides intercommunication facilities. Weight is 9 lb plus control units. (*Burndept, Ltd., West Street, Erith, Kent.*)

Cossor displayed their Gee Mk III miniaturized airborne equipment which is now in use by the R.A.F. and civil airlines. The small size of the indicator unit and its suitability for flight-deck mounting, together with the new simplified position-finding procedure, attracted interest. The airborne transponder for use with the Cossor Type 1 airborne surveillance radar system was also on display. (*Cossor Radar, Ltd., Highbury Grove, London, N.5.*)

Decca showed their new lightweight Flight Log Type 532 airborne equipment which has now completed full aircraft trials. The extent of design efficiency and end use of this equipment can be readily appreciated when its small physical size (total weight is 40 lb) and its clear presentation is seen, and it is evident that the Decca company can be very right in their claim that it is likely to be the answer to the helicopter navigation problem. (*Decca Navigator Co., Ltd., 1-3 Brixton Road, London, S.W.9.*)

Marconi's, with their associated Australian company, showed a complete range of airborne radio equipment covering every commercial and private-owner need. Marconi had on display their intercommunication system Type AD.401 and in a van adjacent to the exhibition tent they were demonstrating their AD.115 140-channel V.H.F. transmitter/receiver, their AD.94 tunable H.F. receiver and their new AD.7092C automatic direction-finder. (*Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex.*)

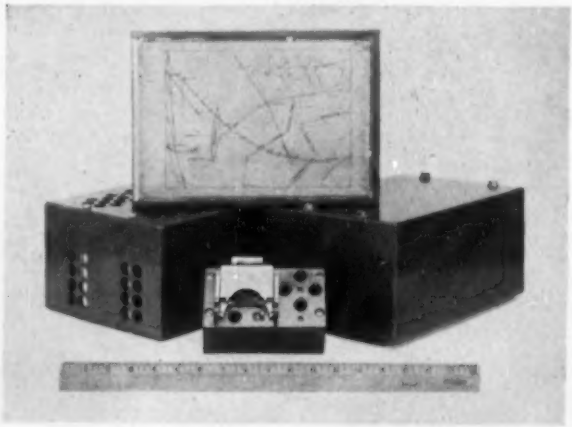
Amalgamated Wireless (Australasia), on the adjacent stand, had a display of their full range of aircraft radio equipment, comprising the HAC-1 ten-channel 60-watt H.F. transmitter/receiver, the HAC-2 120-channel crystal-controlled H.F. receiver, the VAC-1 "Airmite" lightweight V.H.F. transceiver for small aircraft, the VAN-3 200 mc/s double-pulse D.M.E., and their ACA-1C intercommunication system. Several interesting items of specialized test equipment in field maintenance and workshop service were also on display. (*Amalgamated Wireless [Australasia], Ltd., Sydney, N.S.W.*)

Mullard, in addition to their transistor intercommunication demonstration, showed a range of new valves for aircraft radio use together with their range of special quality "Plus" valves featuring increased reliability and life. (*Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.1.*)

Murphy had a comprehensive display which included their V.H.F. transmitter/receiver which can be made a 5-, 23- or 36-channel equipment at choice by using one of three different control units. Also on show was their MR69A passenger announcement system which is now installed in all B.E.A. Viscounts and Elizabethans, and their VR 61 voltage regulator. (*Murphy Radio, Ltd., Welwyn Garden City, Herts.*)

Plessey exhibited their PTR-61 V.H.F. transmitter/receiver for light aircraft; this simply operated six-channel, crystal-controlled set with a weight of 17.6 lb has proved itself and is in wide use in a number of

New Decca lightweight Flight Log, Type 532. Left, miniaturized receiver; right, power pack and torque converter; above, display head; below, control box. The total installation, with cabling, weighs about 40 lb.



The new V.H.F. antenna for helicopters, by Standard Telephones and Cables. It has a standing-wave ratio of better than 1.15 to 1.

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air forces and airlines throughout the world. *(The Plessey Co., Ltd., Ilford, Essex.)*

Redifon had on display their APA-1 aircraft passenger announcement system which has been supplied to B.O.A.C. and to Trans-Australia Airlines for their Viscounts. *(Redifon, Ltd., Broomhill Road, London, S.W.18.)*

Standard Telephones had arranged an interesting and well presented display of their large range of airborne radio equipment. Besides the highlights mentioned earlier, there was an instructive breakdown exposition of the STR.12D 140-channel V.H.F. transmitter/receiver, showing effectively the value of the plug-in sub-assembly construction and the clean design of this equipment. Also on show were the SR.14/15B instrument landing system, comprising a 12-channel localizer receiver; 12-channel glide slope receiver; 75 mc/s marker-beacon receiver, together with a three-light marker relay unit; and the STR.30B radio altimeter, with its two ranges of 0-500 and 0-5,000ft. The work of this company in the antenna-design field was illustrated by the variety of antennae on display—namely, a 75 mc/s marker suppressed antenna, the suppressed antennae of the radio altimeter, the new V.H.F. helicopter antenna mentioned earlier, and a localizer blade antenna which is a standard fitment on all Viscounts and many other aircraft. *(Standard Telephones and Cables, Ltd., New Southgate, London, N.11.)*

It can thus be seen that the British aircraft radio industry is now in a very healthy condition. Not only has the existence of new designs been disclosed, but many are already in quantity production and are being delivered against current orders.

Provided, therefore, that the industry continues to pay due regard to the requirements of the overseas customers as well as the domestic market, there need be no fear that it will suffer from lack of orders. This point is amply illustrated by the success, in the aircraft field, of the Viscount and the fact that the majority of orders are for export.

GROUND RADAR AND RADIO

—and Lighting Equipment: a Survey of the Farnborough Show Exhibits

THE most interesting aspect of the Show as regards radio and lighting equipment was the consolidation of designs rather than the presentation of new equipment—there was, in fact, very little new ground equipment, though a notable exception was the secondary surveillance radar mentioned below and intended for use at civil (and, for that matter, military) airports. Looking at the exhibits from the point of view of one concerned with installing and operating radio equipment, it was a little disappointing to find manufacturers still trying to sell, for civil use, equipment designed expressly to meet military needs. Whilst this is understandable from a purely commercial point of view it does not take into account the essentially different conditions of operation of equipment that are considered desirable for civil purposes. Apart from one or two lapses of this kind, however, the exhibition did prove that British manufacturers were supplying a range of equipment sufficient to meet all civil requirements. More detailed comments on the equipment are listed under several general headings.

RADAR EQUIPMENT. *Cossor* were making the first public display of their new secondary surveillance radar, developed in conjunction with the Ministry of Transport and Civil Aviation and shortly to be given an extended trial at London Airport. This equipment works on the 1,200 mc/s band, having a 500-watt ground interrogator and a 300-watt airborne responder. The responder is coded in one of four codes and the P.P.I. display at the ground station shows a corresponding number of responses. As different interrogation and reply frequencies are used, the display is free from permanent echoes, while the use of a relatively low frequency ensures that the set will work through rain and clouds without sensible loss of performance.

The airborne equipment is small and light (weight, excluding cabling, is approximately 30 lb) and conforms to C.A.B. requirements. The set will be tested in conjunction with the long-range radar at London Airport, where it will no doubt be necessary to develop suitable traffic-control techniques in order to make full use of the great potentialities of the system. Also shown by the same firm was the airfield control radar Mk 6, which has been in use at London Airport for some time and which incorporates M.T.I., video mapping and offset display.

The other radar set of particular civil interest was the precision approach radar (P.A.R.) displayed by *Standard Telephones and Cables*. This set is fully mobile and has a radio link to transmit the radar display information back to the control tower. Although designed specifically to meet civil needs the set is, of course, very

Standard Telephones' remote azimuth and elevation indicator for precision approach radar.

Cossor secondary radar, showing the special aerial design.

suitable for military needs by virtue of its mobility. (Combined with the Cossor airfield radar, these two sets meet the I.C.A.O. specification for ground control approach radar.) The P.A.R. was especially interesting from the point of view of ease of maintenance and alignment, great care having been taken to ensure that the aircraft glide-path shown on the elevation scope correspond exactly with the true glide-path. This, as radar engineers know, is no easy problem to solve.

Two other radar sets were displayed: the *Ekco* combined radar and V.H.F. D/F. which is suitable for use by one man, and the *Decca* Type 424 transportable short-range radar. The latter equipment is essentially a military set in which emphasis has been placed on light weight and transportability. It would require some modifications to be really suitable for civil use—in particular, the aerial pattern in the vertical plane requires broadening to a cosecant squared shape to avoid the necessity of having to change the tilt of the aerial when following aircraft at maximum or minimum ranges. Not shown was the Decca millimetre (8 mm) radar which has been specially designed for giving information about aircraft movements on an airport or of ship movements in harbours. This set will shortly be installed at London Airport to assist the traffic controllers in expediting the flow of air traffic on the taxiways.

INSTRUMENT LANDING SYSTEMS. There was disappointingly little of this type of equipment shown, the only example being the remote control and monitor unit of the *Pye* equipment. It is understood that this equipment is to be modified in the near future to give improved performance and reliability.

NAVIGATIONAL AIDS. Five years after the international agreement at I.C.A.O. on a 1,000 mc/s D.M.E. specification, the present-day situation is most unsatisfactory in regard to the operational use of this valuable aid to traffic control. In the United States the system is in conflict with the military system of TACAN; in Australia a non-standard 200 mc/s equipment, incompatible with the Australian equipment, is being produced to meet the needs of B.O.A.C. on its overseas routes, and especially for jet operation.

Whilst Decca is being considered as a short-range civil navigational aid there is some excuse for not pressing the development of 1,000 mc/s D.M.E. in the United Kingdom. But, if the Corporations should favour the use of V.O.R./D.M.E. there is no reason why the internationally agreed specification should not be used or, alternatively, if this specification is too complicated, an effort be made to have the specification changed in favour of a simpler 200 mc/s system. (Further efforts would, in this latter case, be highly desirable to harmonize the British and Australian systems.) As the United States opinion on D.M.E. and TACAN should shortly be resolved, let us hope that this unsatisfactory situation will be settled as soon as possible. After all, why have international standards if we don't abide by them?

Murphy were displaying the ground and airborne equipments for the 200 mc/s system and *Ferranti* were showing an airborne equipment for the 1,000 mc/s system. Pye have also announced their intention of manufacturing 1,000 mc/s airborne equipment under licence from Hazeltine of the U.S.A.

In the case of V.O.R. the situation is fairly satisfactory, in that equipments are now being installed throughout Europe, and especially at the busy traffic points near airports. The *Marconi* V.O.R., which was displayed in model form at Farnborough, has been tested on an operational basis at London Airport and found to give satisfactory results. Several more of these equipments will be installed at suitable places in the United Kingdom to give guidance on the airways. It is fairly generally agreed that many of the present-day traffic control problems arise from lack of accurate track guidance aids (the M.F. range is very unsatisfactory) and the sooner all navigation can be carried out on V.O.R. the easier will the traffic controller's job become. But, until all scheduled and charter aircraft are fitted with suitable receivers, the V.O.R. system will not displace the present M.F. ranges which form the basis of the airways system.

In the case of non-directional beacons it was heartening to see production of monitoring and automatic changeover equipment for these aids. In the past, administrations have had to make their own equipment and rely on the use of traffic control or communications personnel to check the modulation and coding of these beacons. *Burndept* were displaying a dual beacon with auto-changeover and *Labgear* a remote monitoring receiver with audible and visible alarm in event of carrier or modulation failure. Marconi also make a change-over unit, but this was not displayed. Some desirable improvements in these types of equipment would include means for indicating remotely by radio receiver whether the beacon is on main or stand-by equipment and for ensuring reliable operation of the remote monitor in the presence of static—which, in the band 200-400 kc/s, is at times heavy.

Other navigational aids displayed included the *Decca* system and its associated system, Dectra, which has been proposed for long over-water routes. From a civil aviation point of view the future of these aids is not yet clear. Whilst Decca undoubtedly provides the most suitable guidance to helicopters (particularly because of coverage to ground level in the vicinity of buildings) it is at present problematical whether administrations could afford to provide this system exclusively for helicopter operation. The operation of civil helicopters under instrument conditions could undoubtedly be provided for in several ways; and, as the volume of traffic to be catered for in the next few years is small, it would perhaps be premature to make a firm decision in this regard. The Dectra system will be evaluated in the near future as a result of the recommendations from the fifth session of the Communications Division of I.C.A.O., along with other aids, such as Consul and Navarho.

Static version of Decca 424 radar scanner.

A V.H.F. direction-finder console with large-scale meter pre-

"Flight" photograph

Murphy 200 mc/s D.M.E. ground beacon, monitor and change-over unit.

GROUND RADAR AND RADIO . . .

sentation was displayed by *Marconi*. This equipment is designed expressly for control-tower use and has, in addition, a D.C. output to enable the direction information to be superimposed on a radar P.P.I. tube. *Standard Telephones and Cables* also make a cathode-ray display type of V.H.F. D/F., but this was not exhibited.

COMMUNICATIONS EQUIPMENT. Virtually nothing new in this category was displayed at the Show, but there was a range of H.F. and V.H.F. transmitters and receivers to cover all possible needs for civil purposes. Some of the more interesting features should be mentioned. *Marconi* were showing a range of V.H.F. equipment and associated remote control and controller's desk, designed in conjunction with *International Aeradio*. Use was made of the muting circuits on the receivers to indicate which of the receiver channels was being used, thus enabling the controller to discriminate between the several channels fed into one loud-speaker. *Plessey* and *Redifon* were both displaying a complete range of frequency-shift-keying transmitting and receiving equipment which can be connected directly to teleprinters for radio-teletype operation. The receivers can also be arranged for diversity operation.

Also on display by *Plessey* were aerial multi-couplers for H.F. and V.H.F. receivers, allowing ten and six receivers respectively to be operated from one aerial. In the case of the V.H.F. couplers an improvement in performance results from their use—a gain of several decibels being achieved with a noise factor of 8 db. In both couplers the attenuation between adjacent outputs is of the order of 40 db. and is normally sufficient to prevent interference between receivers.

A 14-channel speech recorder for airport use, displayed by *Thermionic Products*, should cater for the recording requirements of even the largest airport. The only other British recorder (which was not on show) suitable for airport work is the *Simon* four-channel recorder. In each case the duration of recording is only four hours; but by using several equipments automatic operation for eight or twelve hours can be achieved. Completely to satisfy civil requirements, some continuous and automatic monitoring of the operation of the various channels is needed so that the recorder may be changed over in the event of any one of the channels not functioning normally. It is undesirable to have to retain technical staff to do this work.

It was disappointing to see no display of, or reference to, semi-automatic tape relay equipment for teleprinter communications. There is without doubt a fairly wide market for this equipment in Europe and elsewhere in order to meet I.C.A.O. standards on message delays at communication centres, and at least one Continental manufacturer has been quick to produce suitable equipment.

AIRPORT LIGHTING. Various types of airport lighting fittings displayed by two firms (*General Electric Co., Ltd.*, and *Revo Electric Co., Ltd.*) covered runway, approach, taxiway and obstruction lights. On the low-intensity lighting side the trend is toward elevated and light-weight fittings so designed as not to damage aircraft should they run into them. Both firms showed omni-directional lights for this purpose, with an intensity of the order of 300 c.p. from 36-watt lamps. High-intensity approach lights to meet the I.C.A.O. requirements as regards intensity and beam-spread were also shown.

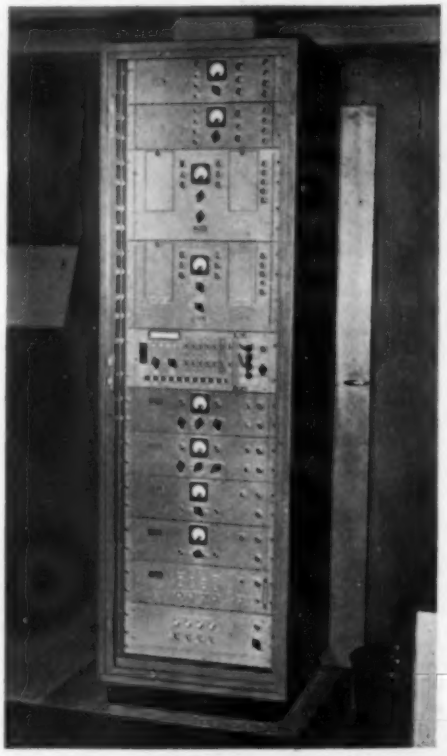
In the matter of high-intensity runway lights, however, there are still widely differing ideas on the desirable type of light unit and official indecision is reflected in the variety of light fittings available. The case of high-intensity threshold lights is even worse and the fittings displayed by no means fulfil the I.C.A.O. requirements that they should have an intensity comparable with that of the runway lights. The problem of threshold-light design is admittedly a difficult one, as is also the question of the placement of these lights to give the maximum assistance to pilots in poor visibility; but it is one that must be solved soon if runway and approach lighting is to prove its real usefulness.

Standard Telephones and Cables were displaying a remote-control system and display panel for airport lighting which is very suitable for small and medium-size airports and which gives complete supervision of the correct operation of all circuits and an alarm in the event of any failure. One control wire per function is used. The system is much simpler than the one installed some time ago at London Airport, which was capable of infinite extension and which used only five control pairs. In addition the control panel can be "tailor-made" to suit the airport concerned.

CONCLUSION. Both electrically and mechanically the standard of engineering design was, with minor exceptions, very satisfying, as was the quality of component parts now being used in equipments. (For this latter fact, credit must also be given to the fine Inter-Services Components Specifications, as well as to manufacturers.) After all is said and done the responsibility for poor equipment can usually be placed in the long run on the Government departments concerned—if they do not know exactly what they want in the way of quality and performance the manufacturers can hardly be blamed for not producing it. When these departments do make up their minds, then the manufacturers can really "turn out the goods," as the Farnborough stands proved.

Marconi V.H.F. equipment, showing transmitters, receivers and control equipment (respectively) in the racks at the rear, and a portion of the I.A.L. control desk in the foreground.

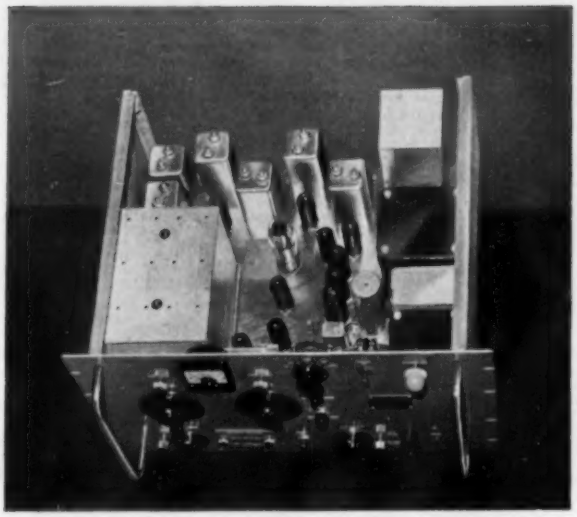
"Flight" photographs



Plessey frequency-shift keyer drive unit, with duplicate keyer units and keyer amplifiers. Crystal operation on any one of eight frequencies is available.

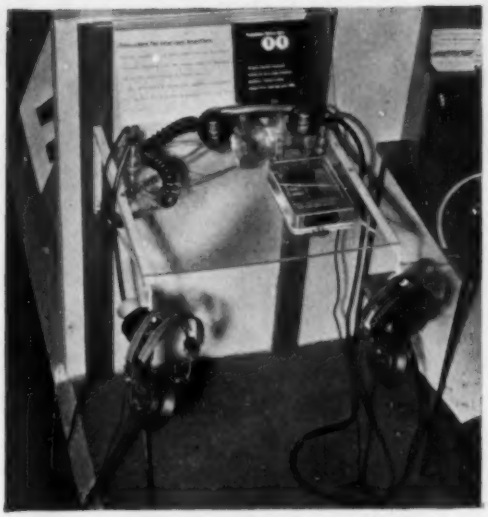
OTHER EXHIBITS

Air Trainers were showing a new general-purpose electronic radio aid unit which can be coupled to flight simulators and instrument trainers to provide realistic simulation of all modern day radio navigational aids. The types of aid that can be simulated include I.L.S., and radio compass and, where necessary, D.M.E. and Zero Reader. *(Air Trainers, Ltd., Aylesbury, Bucks.)*



Burndept Type BE225 receiver for civil and military use on 100-156 mc/s.

"Flight" photographs



Mullard transistor-type intercommunication amplifier.

Burndept displayed a range of V.H.F. ground equipment for both fixed and mobile use. Of special interest were the new V.H.F. receiver (which will be used by the Services and by the Ministry of Transport and Civil Aviation) and a compact 50 watt ground to air V.H.F. transmitter. The TALBE, talk-and-listen beacon for emergency use was again displayed. *(Burndept, Ltd., Erith, Kent.)*

E. K. Cole. This firm's compact and portable airfield approach radar aid was again displayed, together with V.H.F. transmitter and receiving units. The approach aid enables one man to give an aircraft guidance to within approximately half a mile of the runway and combines a direction-finding system to assist in bringing the aircraft on to the correct final approach path. The V.H.F. equipment included a 20 watt amplitude modulator transmitter and crystal-stabilized receiver together with control equipment. *(E. K. Cole, Ltd., Southend-on-Sea, Essex.)*

Cossor were again displaying their airfield radar Mk 6, together with the new secondary surveillance radar as well as modern-type Gee transmitting and receiving equipment. The airfield radar Mk 6 has facilities for moving target indication, video mapping and the superposition of D.F. information. Furthermore, the displays can be offset to provide coverage over selected sectors. The secondary radar provides a means of positive identification of aircraft up to a range of 150 aeronautical miles from the ground stations and up to altitudes of 50,000ft. A particular feature of the equipment is the relatively low power required for reliable operation—in this case approximately 500 watts peak. The Gee equipment has been designed for replacing existing ground transmitting equipment and permits a reduction in staff as well as providing more reliable timing devices. *(Cossor Radar, Ltd., Highbury, London, N.5.)*

Decca made a feature of their Type 424 air-transportable ground radar and also gave details of their proposed long-range navigation system Dectra. Information was available, too, on the complete range of radar sets manufactured by this company, including the new airfield surface movement indicator radar which is to be installed at London Airport. The Type 424 radar is also available for fixed installation, e.g., on civil control towers. The equipment is duplicated throughout to provide reliability and has two display units which may be used independently on different ranges to allow one controller to marshal the aircraft and the second controller to give landing instructions to pilots. The Dectra system, as yet in the proposal stage, is intended to cover long over-water flights and is a possible replacement to Loran or Consul. *(The Decca Navigator Co., Ltd., 1-3 Brixton Road, London, S.W.9.)*

Ferranti. This firm showed a prototype of their new Mk 2 version of the airborne distance measuring equipment which will also give homing information as well as distance information. This equipment is in one box 12in × 8in × 12½in and is much lighter than the Mk 1. This firm has already manufactured the ground beacon for 1,000 mc/s D.M.E., but it is understood that this will be redesigned in the near future for civil use. *(Ferranti, Ltd., Crewe Toll, Edinburgh.)*

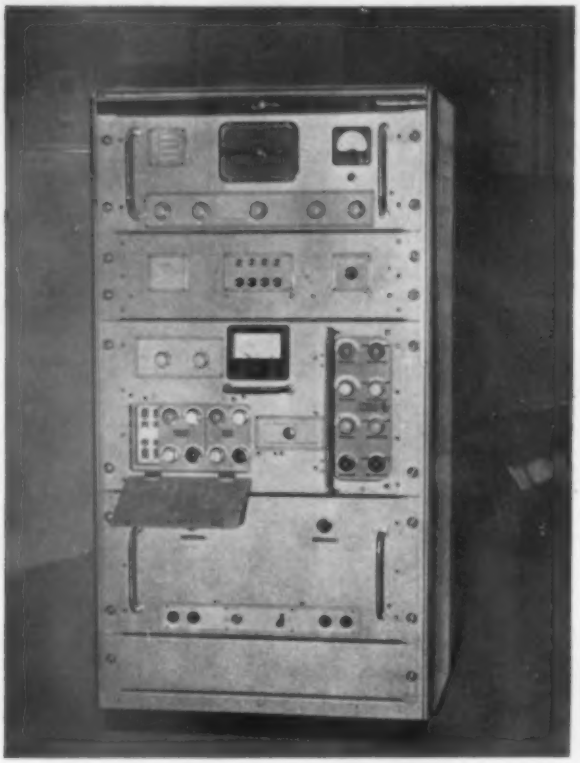
G.E.C. were displaying a range of their airport lighting fittings suitable for both civil and military airports. Included in the fittings were a new flush-type threshold light and two new elevated runway lights—one high-intensity bi-directional type using a combination of mirrors and plastic lenses and the other a low-intensity omni-directional light using a plastic lens. *(General Electric Co., Ltd., Kingsway, London, W.C.2.)*

Marconi. Associated with this company in the display were Marconi Instruments, Ltd., the Canadian Marconi Co. and Amalgamated Wireless (Australasia), Ltd. The main items displayed were a selection of V.H.F. ground and control equipment suitable for use in civil and military airports coupled to a control desk designed by International Aeradio, Ltd. Also displayed were a model of the V.H.F. omni-directional range which is at present installed at London Airport, and the V.H.F. direction finder Type AD.200. Other items shown included test equipment for the Australian-made 200 mc/s distance-measuring equipment, a voltage standing-wave ratio bridge and a range of signal generators and test sets. *(Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex.)*

McMichael. This firm was displaying a range of test equipment suitable for both ground and airborne radio apparatus. *(McMichael Radio, Ltd., Slough, Bucks.)*

Mullard. Two classes of exhibits comprised, firstly, a range of valves from transistors to 4-kilowatt capacity and their circuit applications and, secondly, a range of H.F. communication receivers and transmitters. The transmitters were of particular interest in that they have been designed to allow for c.w., r.t., s.s.b. and i.s.b. operation by merely changing the exciter unit. The firm were also displaying their new Type CT 80 valve tester, which utilizes a punched-card system which has set up on it the necessary measuring conditions for each type of valve. Also on display was a high-stability variable-frequency oscillator for use in the band 2-5.1 mc/s and which has a stability of plus or minus 0.003 per cent. The equipment is set up to the correct frequency by using a gated electronic counter of suitable accuracy. An interesting exhibit was the inter-communication amplifier, employing transistors throughout instead of conventional valves and requiring an extremely small amount of power for its operation. *(Mullard, Ltd., Shaftesbury Avenue, London, W.C.2.)*

Ekco combined approach radar and D/F equipment, suitable for one-man operation.



Pye 50-watt 4-channel H.F. transmitter with remote control of the channels.

"Flight" photographs

GROUND RADAR AND RADIO . . .

Murphy. On this stand was to be found the company's 200 mc/s D.M.E. ground beacon and associated test and monitor equipment and also a field-strength measuring set and an interference tracing set covering the ranges 30 to 150 mc/s and 30 to 100 mc/s respectively. Information was also available, though the equipment was not displayed, on their 50-watt V.H.F. transmitting equipment suitable for civil or military use. The D.M.E. ground beacon is fitted for remote control, and can be operated up to distances of 4½ miles over normal telephone control lines. It has a peak power output of 1 kilowatt and the associated aircraft interrogator unit has a peak power output of 800 watts—in both cases 5-microsecond pulses are used. (*Murphy Radio, Welwyn Garden City, Herts.*)

Plessey. Included in this exhibit were a new aerial multi-coupler for V.H.F.; Type A simplified frequency shift keyer receiving terminal; frequency shift keyer transmitter drive unit; and a two-tone modulator de-modulator for D.C. keying. The firm also manufacture a complete range of equipment for frequency shift key operation which can be assembled according to a customer's requirements. In addition, a range of V.H.F. receivers and V.H.F. transmitters is available. The aerial multi-coupler gives six outputs for one input and provides an isolation between output sockets of more than 40 db, relative to the insertion loss of the multi-coupler. The teleprinter receiver terminal is complete with pre-selectors, receivers, frequency and keyer amplifier and can operate up to three teleprinters directly. Also of interest on this stand was the new frequency synthesizer Type XT.9 which allows any one of 100,000 frequencies at 1 kc/s intervals to be set up in the band 1 kc/s to 100 mc/s with a stability dependent only on the initial supplying oscillator. (*Plessey International, Ltd., Ilford, Essex.*)

Pye. On this stand was to be found a range of V.H.F. fixed and mobile communication equipment, a new 50-watt four-channel H.F. transmitter, and an example of the 1,000 mc/s D.M.E. airborne interrogator unit which the company propose to manufacture under licence from the American firm of Hazeltine. Also shown in photographs was the installation recently made for the Wellington Air Traffic Control Centre, New Zealand, of all the radio link and air ground communications equipment. On this stand was displayed a M.F. beacon monitor receiver made by **Labgear (Cambridge), Ltd.**, which provides automatic monitoring and alarm of remote non-directional beacons. This equipment will avoid the need for manual monitoring of beacons which is the method presently used. Included in the portable V.H.F. equipment is the Walkiephone, and also the Reporter, the latter being suitable for installation in ground vehicles used on aerodromes to provide communication with the control tower. (*Pye, Ltd., Cambridge.*)

Redifon. This firm was displaying a fairly complete range of communication equipment, both H.F. and V.H.F. as well as M.F. radio navigation beacons. The transmitter Type G.142 provides a dual M.F. beacon installation with a monitor automatic change-over unit making the whole equipment suitable for remote unattended operation. The output of this transmitter is 80 watts, the power radiated being dependent upon the type of aerial system used. Also shown was a transmitter Type G.143 giving 1 kilowatt output in the range 2-26 mc/s. This transmitter can be pre-tuned to 10 frequencies and can be remotely controlled over a pair of wires up to a distance of 25 miles. Equipment for frequency shift keying also shown, using special receivers and combining keyer units. (*Redifon, Ltd., Broomhill Road, London, S.W.18.*)

Revo were exhibiting a range of airport lighting fittings, including a new light-weight approach light and a light-weight omni-directional runway light. Also shown were a flush type taxi-way light and a flush threshold light. Other fittings include obstruction lights and floodlights for apron area, etc., and transformer boxes suitable for direct burial in the ground. (*Revo Electric Co., Tipton, Staffs.*)

Schermuly. Of particular interest among this firm's range of pyrotechnic flares and signal devices were portable ground flares for distress purposes and for assisting emergency landings at night. These flares give an intensity of over 1,000,000 c.p. for a period of 3½ or 7 minutes, according to size. Another unit was that which projects a flare to a height of 1,200 feet to attract the attention of aircraft. (*Schermuly Pistol Rocket Apparatus, Ltd., Newdigate, Surrey.*)

Standard Telephones were displaying their precision approach radar (P.A.R.) equipment and also developments in rectifiers and quartz crystals. The P.A.R. is designed for remote operation over a radio link and has been constructed with a view to reliable operation and easy servicing. The aerial system and mounting is so designed that it may be correctly levelled and adjusted and in addition may be easily transported from one site to another. Separate azimuth and elevation display units are provided and the equipment is stated to give a reliable echo on aircraft to at least ten miles. A particular feature of the display is the use of a logarithmic distance scale to obviate the need for changing the scale when the aircraft is approaching the end of the runway. The new high-frequency overtone crystals working on the 3rd and 5th overtone were displayed together with suitable circuits. These can be used up to 60 mc/s and simplify the design of V.H.F. transmitting equipment. The firm hope to make crystals available which can be used in oscillator circuits up to 100 mc/s. Also shown on this stand was the airport lighting control system and facsimile panel to indicate the lighting circuits actually in operation on an aerodrome. Two types of equipment are available—that using one wire per function for control and supervision and that employing a pulse system which will provide an indefinite number of facilities over a five-pair cable. Both systems provide true monitoring of the circuit and give aural and visual alarms in the event of any malfunctioning. (*Standard Telephones and Cables, Ltd., New Southgate, London, N.11.*)

Thermionic Products showed their 14-channel recording equipment for use at airports for monitoring ground/air and other communications associated with traffic control. One of the 14 channels is used for timing, which is provided by coded signals from a special clock unit supplied with the recorder. The equipment gives approximately four hours recording per reel of tape and has automatic switching from one reel to another in the event of tape running out or a mechanical fault occurring. (*Thermionic Products, Ltd., Hythe, Southampton.*)

Ultra. This firm was displaying their Sarah air/sea rescue system, referred to under "Air/Sea Rescue Equipment" on page 479. (*Ultra Electric, Ltd., Acton, London*). D. B. F.

Redifon dual 50-watt ground non-directional beacon transmitter and monitor and automatic change-over unit.

Featuring

operational diversity...

The Fairey 'Gannet' is equipped for a remarkable variety of duties and is in the widest sense a multi-role aircraft. Its design provides for every type of anti-submarine duty, whether the changing pattern of attack calls for extreme range or extra-heavy warload, for speed in pinning down a target or extended endurance for patrol. Compact design and twin-engined performance enable the 'Gannet' to counter most effectively the underwater challenge to our sea communications.

FAIREY

Powered by an Armstrong Siddeley "Double Mamba" Engine

GANNET

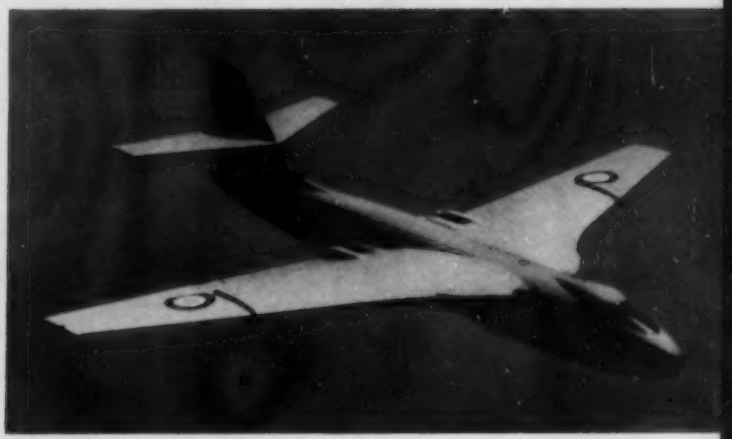
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

THE
FORMULA FOR
SUPERSONIC FLIGHT

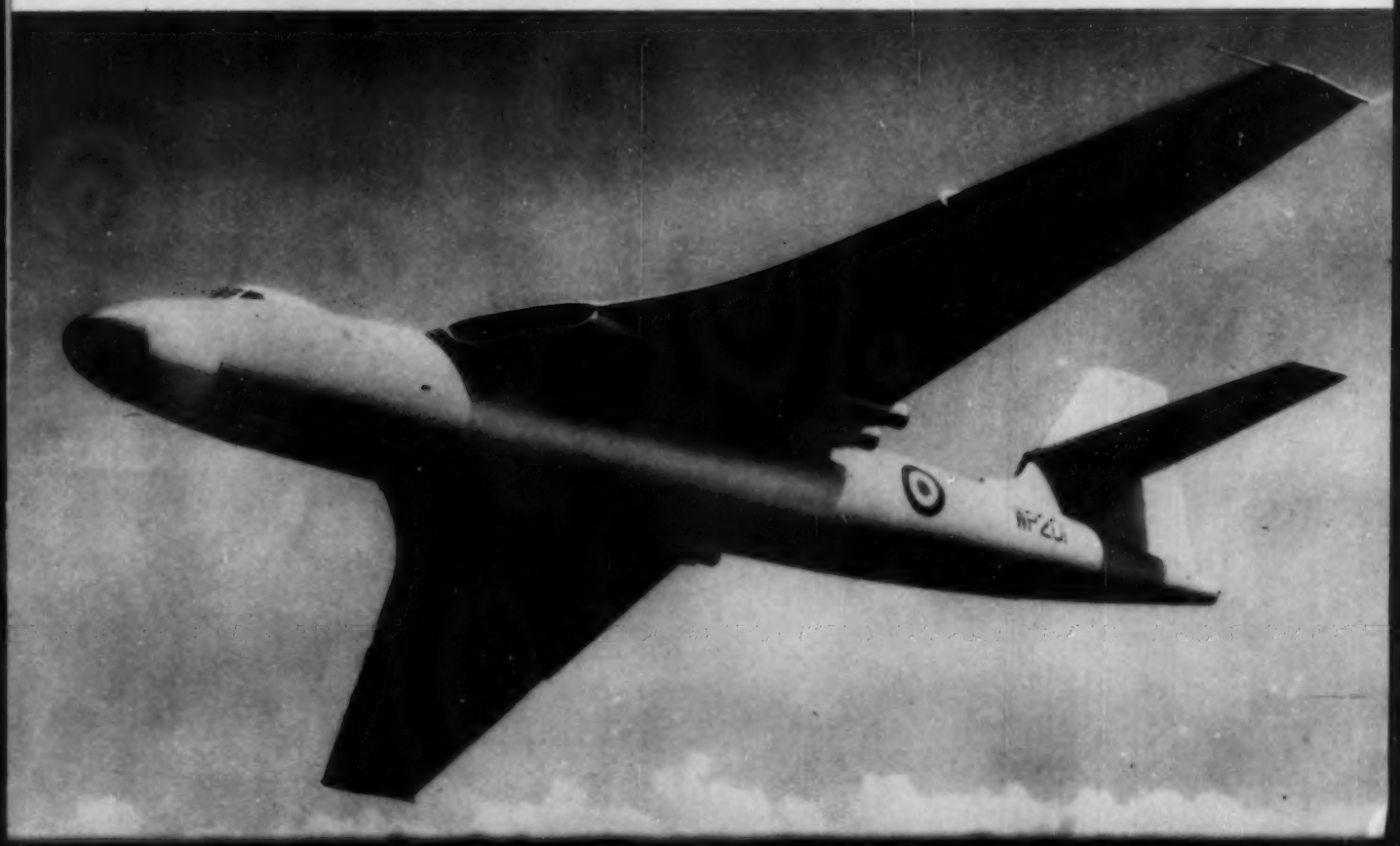
GYRON

D.H.
ENGINES

V-BOMBERS



TWO forms of the Vickers-Armstrongs Valiant—the B.1 and B.2—are flying, but only the former is being built in quantity for the R.A.F. The B.2, two views of which head the page, is evidently a special-purpose bomber, and is distinguished by its lengthened nose, trailing-edge fairings for the bogie under-carriage, and glossy black finish. It has demonstrated speeds of 500 m.p.h. or more at sea level, and must have a structure of exceptional strength. The air-to-air pictures of the B.1 are among the first to show a production aircraft, distinguishable by dielectric panelling in the nose section, and lengthened jet-pipes.



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V-BOMBERS . . .

For affording the special facilities which enabled these remarkable air-to-air studies of the Sapphire-powered Avro Vulcan B.1 prototype to be secured, Flight gratefully acknowledges the co-operation of the Ministry of Supply. The pictures are the work of L. W. McLaren, and were taken a few days ago over Southern England.

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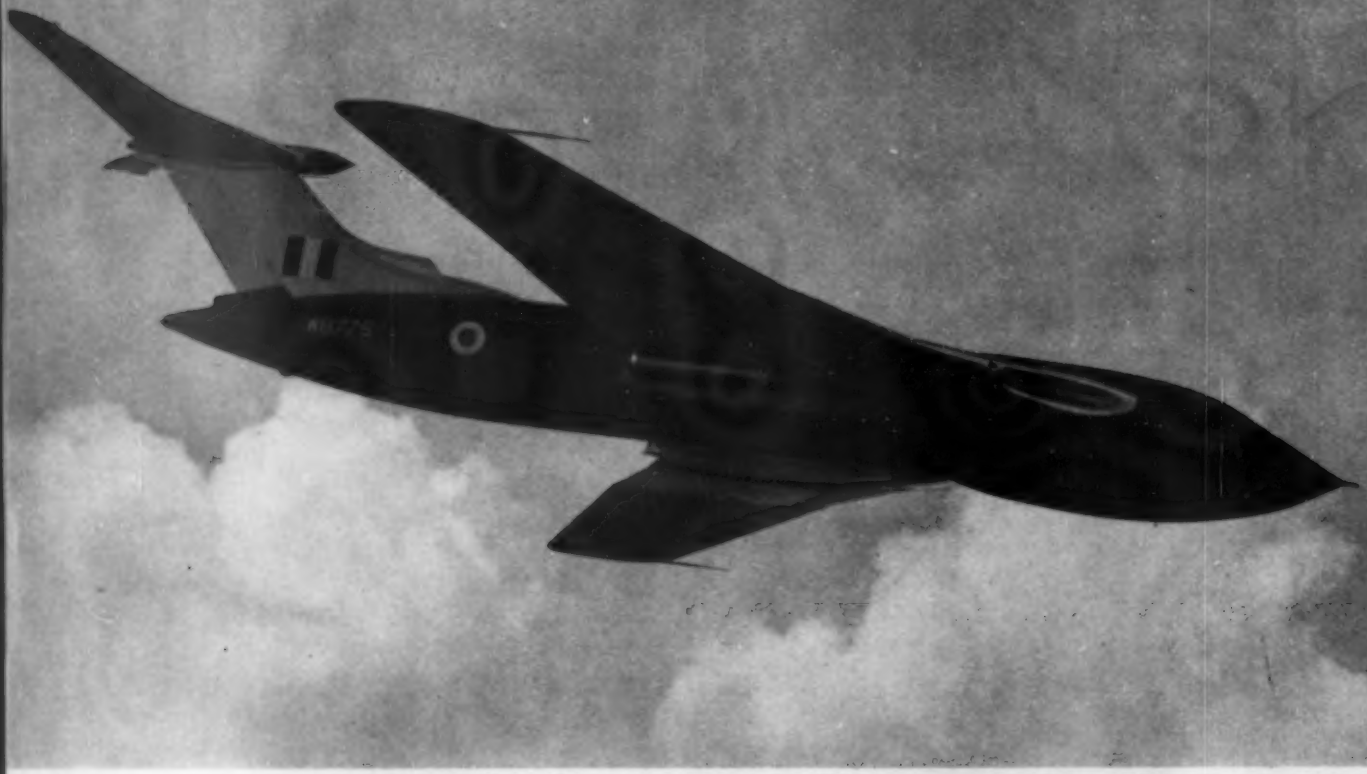
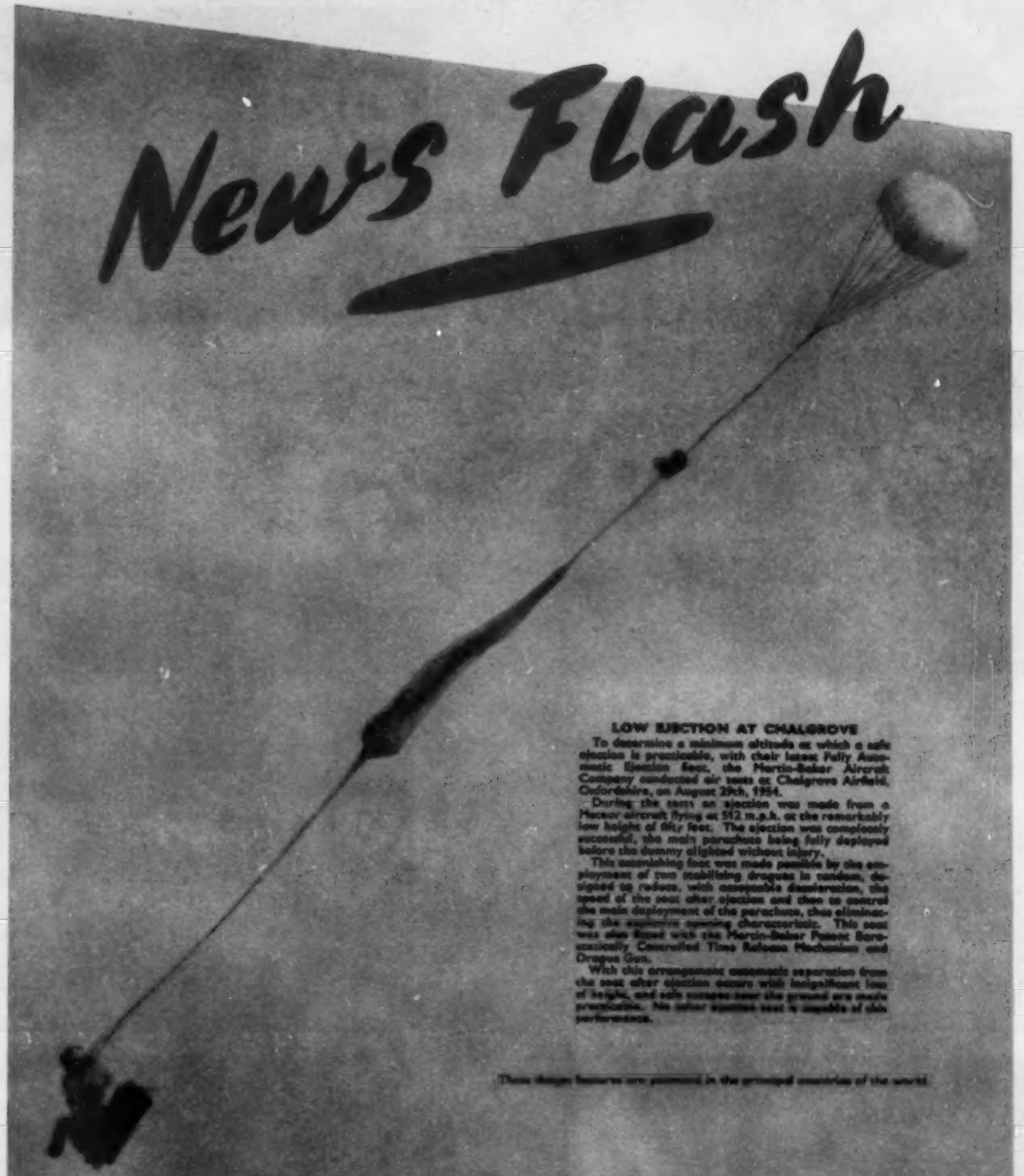


V-BOMBERS . . .

HERE depicted is the second prototype of the Handley Page Victor B.1, powered with four Armstrong Siddeley Sapphires. The characteristic crescent wing was chosen on performance grounds, and embodies "droop-snoot" leading-edge flaps, each in two sections, and rearward-moving trailing-edge flaps, conforming to the jet nacelle contours. Mounted on the tail cone are large, hinged, air-brake panels, which increase drag for deceleration in flight or on landing. The Victor is said to be especially simple to land, and the maker's chief test pilot maintains that any pilot can bring the machine in gently, with power on and with flaps and air brakes in operation, in rain or bad visibility. All that is required of him is to correct for local air disturbances affecting lateral trim until the wheels of the main bogie undercarriage, which number sixteen, touch down. The nosewheel is then brought on to the runway and the brakes applied.

PIONEER DESIGNERS OF THE EJECTION SEAT

News Flash



LOW EJECTION AT CHALGROVE

To determine a minimum altitude at which a safe ejection is practicable, with their latest Fully Automatic Ejection Seat, the Martin-Baker Aircraft Company conducted air tests at Chalgrove Airfield, Oxfordshire, on August 29th, 1954.

During the tests an ejection was made from a Meteor aircraft flying at 512 m.p.h. at the remarkably low height of fifty feet. The ejection was completely successful, the main parachute being fully deployed before the dummy alighted without injury.

This astonishing feat was made possible by the employment of two stabilising drogues in tandem, designed to reduce, with acceptable deceleration, the speed of the seat after ejection and then to control the main deployment of the parachute, thus eliminating the explosive opening characteristic. This seat was also fitted with the Martin-Baker Patent Barometrically Controlled Time Release Mechanism and Drogue Gun.

With this arrangement automatic separation from the seat after ejection occurs with insignificant loss of height, and safe escapes near the ground are made practicable. No other ejection seat is capable of this performance.

These design features are patented in the principal countries of the world.

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED HIGHER DENHAM NEAR UXBRIDGE MIDDLESEX

In Current Production

Pembroke

Internationally acclaimed for communications, freighting, casualty evacuation, supplies dropping, twin engine pilot training and aerial photography, the versatile Pembroke has already been adopted by the Air Forces of Great Britain, Southern Rhodesia, Belgium and Sweden.

Provost Mk. 1

The standard side-by-side two seat ab initio basic trainer in service with the Royal Air Force; also selected for pupil pilot training by the Air Forces of Southern Rhodesia, Eire and Burma.

ARMED Provost

Two machine guns, a camera gun, rockets and bombs, extend the already wide application of this most modern and comprehensively equipped trainer.

JET Provost

Powered by an A. S. Viper 5 turbo-jet, this development of the "Provost" for the Royal Air Force, is the world's first military ab initio basic jet trainer.

HUNTING PERCIVAL AIRCRAFT LTD

A Hunting Group Company

LUTON, BEDFORDSHIRE, ENGLAND and at TORONTO, CANADA.

Behind the Scenes at Farnborough

THIS year the S.B.A.C. flying display was bedevilled by bad weather and on most days the carefully planned programme had to be "played off the cuff" in accordance with minute-to-minute variations in conditions. The outstanding facts are that the final decision about flying or not flying was left to each individual pilot, and that the display was never cancelled.

On many days, as the cloud-base came lower and lower, and the rain squalls drove in from the west, one of the most comprehensive traffic-control organizations in the country took over where the pilots' range of vision ended. On Farnborough airfield at least three radar systems of various types and two D/F. and fixing systems were working in fair weather or foul.

A great deal was written and said last year about the new safety regulations, against which, it was rumoured, the pilots themselves had made strong protests. The principles (and they were principles and not hard-and-fast regulations) were, however, in the best interests of all concerned; and in view of the performance of modern aircraft their introduction was inevitable. The principles of safety were, in fact, approved by the Flying Control Committee of the S.B.A.C., a standing body representing the R.A.E., the Empire Test Pilots School, Farnborough Air Traffic Control and the S.B.A.C., whose members include some of the demonstrating pilots themselves. The committee is composed as follows: Chairman, G/C. S. R. W. Hughes, Superintendent of Experimental Flying, R.A.E.; members, W/C. J. Finch, Wing Commander Flying, R.A.E.; G/C. S. Wroath, Commandant of the E.T.P.S.; Mr. K. I. Pearson, S.A.T.C.O., R.A.E.; John Cunningham, de Havillands; Gordon Slade, Faireys; "Bill" Pegg, Bristols; H. W. Goodinge, S.B.A.C.; and J. Radford, S.B.A.C. This team of experts was in charge of all aspects of the display and first meets some time before the show to decide the timetable and any other matters. The order of appearance and the time to be allotted to each aircraft are decided, according to the type and importance of each. During the show the committee meets daily.

Last year it was decided that some form of precautions should be recommended for all demonstrating pilots. As explained to *Flight's* representative by G/C. Hughes, they are few and eminently sensible, and do not in fact limit the pilot; W/C. Beamont, who had not demonstrated at Farnborough since the principles were introduced, showed conclusively on the Sunday before the show began that it was possible to give a magnificent demonstration without transgressing.

The principles are as follows: no aircraft should fly past at a height of less than 50ft—the height of the control tower; there is no need for it to do so, in any case. A demonstrating aircraft should always be treated as if it had loaded front guns and should not, therefore, be flown over the crowd, nor pointed towards it at a range of less than three miles. Neither should the aircraft be turned towards the crowd at less than this range. (Reasons underlying these principles can be appreciated if it is recalled that the D.H.110 broke up two-and-a-half miles from the crowd when turning towards it and that the engines left the aircraft and caused casualties among the spectators.) Finally, no aircraft should be flown at a speed greater than 95 per cent of the speed for which it had already been cleared.

The general regulations against making sonic booms over land were relaxed for the show, with the proviso that bangs were not to be made unless the dive could be started when the pilot was in visual contact with the field, and that the ensuing pull-out should also be made in V.F.R. conditions.

These principles, as has been said, are not hard-and-fast; application may be made to the committee for certain aircraft to disregard them. For instance such aircraft as the Beaver, the Pioneer and the Auster types, as well as the helicopters, can obviously be flown towards the crowd, turned towards it and flown below 50ft without any danger; and, in fact, such flying would most effectively demonstrate their special qualities. The Pioneer landed towards the public enclosure on Monday in very poor visibility, and touched down and stopped without difficulty across the runway. The Auster A.O.P.9 also was allowed to come down well below 50ft.

During the display itself the pilots were accommodated close to the control tower, in a hut where they had their own bar and buffet restaurant. In this hut every day there was to be seen a gathering such as can take place but once a year: test pilots from every British aircraft company and from the R.A.E., the A. and A.E.E., and the Service, in whose hands every new aircraft has first taken the air in past years, and who hold or have held many of the world's most coveted records. They assembled for each day's briefing on the weather and control procedure and to work out all the minor points which arose during the display. At 11.45 each day that week G/C. Hughes opened the briefing, and Mr. Hall, the meteorologist, summarized the weather situation, which was on many days apparently hopeless. On the first day G/C. Hughes explained the safety precautions and Mr. Pearson, the S.A.T.C.O., recently joined from Blackbushe, outlined the radio frequencies and procedures, the radar facilities and the emergency arrangements and diversions.

Eight crash crews were on duty, three on the airfield itself and the remainder distributed at strategic points in the surrounding country. All were in constant radio communication with the tower through the Pye V.H.F. ground radio sets. Blackbushe and Odiham, the two diversion airfields were also listening out on the Farnborough frequency ready to receive aircraft in trouble or diverted. The army had provided a crash crew capable of reaching aircraft down in the wild tract south-west of the airfield, a region inaccessible to normal road vehicles.

A prohibited area was in force for a radius of five miles round the field, from the ground to a height of 50,000ft and a danger area at ten miles radius up to 11,000ft and at 20 miles from 11,000ft to 50,000ft. A 10 cm airfield control radar set, C.R.D.F. and semi-automatic pictorial fixer pattern were supported by a Decca 424 airfield radar and precision approach aid. High-intensity Calvert lighting was installed on the 25-07 runway with a "bar" on the approach. Mr. Pearson and Mr. Pendry were in charge of the flying control in the glass-fronted balcony of the tower, while all the radar and D/F. apparatus was grouped in a hut some way from the tower. Up to three aircraft at a time could be comfortably controlled by radar in the circuit during the show, although many more can be, and are handled when necessary.

Stage Management

The timing of the show itself was very carefully worked out and run on a split-second basis. The first aircraft took off at "Z" hour, 1429 hr, and each one then had a take-off time of "Z" plus a given interval. As one pilot called "downwind," the next to demonstrate took off. All aircraft were parked in such a way that either the 25 or 07 runways could be used as the wind dictated, and the time required to taxi from dispersal to the end of the runway was taken into account in marshalling.

Friday, the first public day, produced typically marginal weather conditions. Some time before the display was due to start, the control tower was fully manned and contact established by landline and radio with the radar and C.R.D.F. controllers (in a small brick hut on the airfield) and with the fire and police crews. A Naval S-55 helicopter and a Westland S-51 (co-opted for the occasion) were standing by at instant readiness for crash rescue duties. Mr. Pearson, the S.A.T.C.O., was at his desk, with his assistants on the landlines to "Radar" and the rescue services. Behind them, G/C. Hughes, W/C. Finch and John Cunningham were representing the flying-control committee.

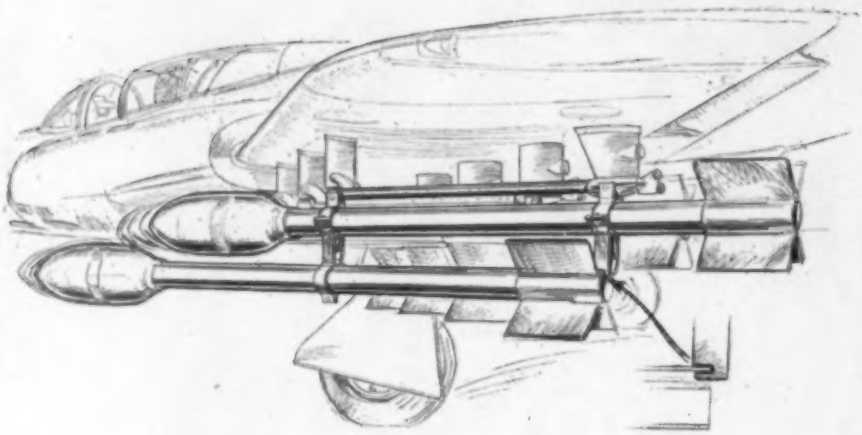
Shortly before the show started, Bill Bedford of Hawkers called by radio that he was approaching the airfield and wished to make an emergency landing because of fuel fumes in the cockpit. He was immediately cleared to land from the tower and simultaneously talked down by Radar, and then directed to a parking space.

At "Z" hour, the Proteus-Ambassador was directed to line up and lead the first circus away; and as the evolutions of the circuses continued, Radar and A.T.C. talked them round their circuits and co-ordinated their movements in the air and on the ground. John Cunningham spotted that the Beaver's starboard pilot's door was missing, and a solicitous enquiry from Mr. Pearson elicited the reply from Pat Fillingham, the pilot, that "I've got the door in the back of the aircraft. We had a bit of trouble." As soon as the Olympus-Canberra bored its way into cloud on take-off, Radar took over and directed it round its circuit. As Jim Cooksey demonstrated the Meteor N.F.14, the cloud-base dropped to the ground in places; and when he called for and was given a vector back to the airfield, he was asked what the cloud base was. His reply was short and to the point, and thereafter demonstrations were limited to straightforward fly-pasts.

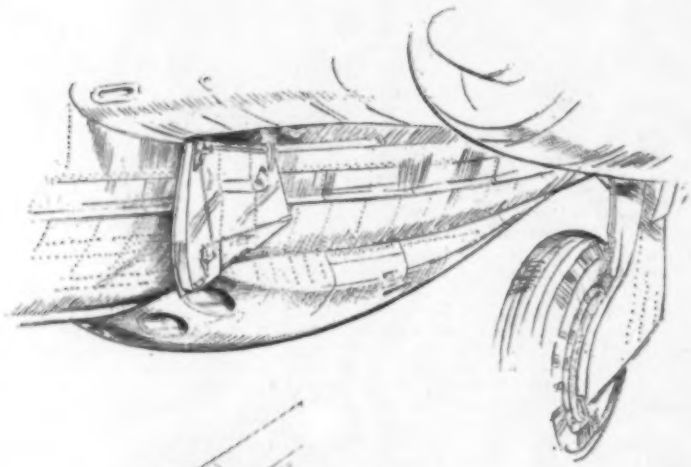
As the individual demonstrations began, the weather was, if anything, worse; G/C. Hughes and Mr. Pearson were fully occupied directing and keeping track of each aircraft. Radar told Mr. Pearson by landline where each aircraft was, and each pilot's calls were answered as appropriate either by Radar or from the tower, so that both agencies worked together.

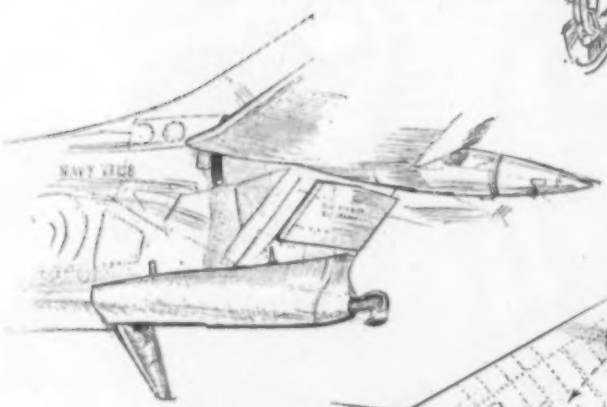
Then, towards the end of the display, Neville Duke's unmistakable voice was heard from the Hunter 6 saying he intended to make a fast pass. The aircraft's wake gave the tower a distinct jolt as the pale green Hunter passed; and yet, for all his speed, Duke felt his way back to the airfield by an instinct and judgment which are reportedly unsurpassed. He required, and was given, no navigational assistance in his demonstration. Finally, Dave Glasser was talked in in the T.A.A. Viscount, and W/C. Finch, watching him through the tripod-mounted telescope in the tower, remarked on the fact that the weather was now so thick that the pilot had his cockpit lighting turned on.

FARNBOROUGH SKETCHBOOK

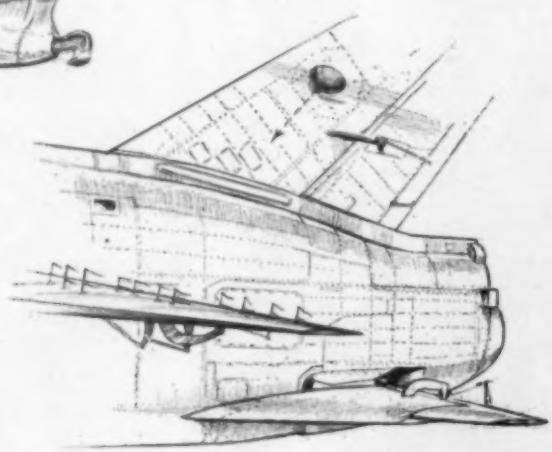


The Supermarine Swift F.4 (left) carries eight 60 lb rocket projectiles on zero-length rails under each wing. The suspension arrangement is shown as a detail. (The forward pick-up is similar but incorporates a latching device.) Below is illustrated the underslung housing for the four 20 mm guns on the Canberra B.8 night intruder. The guns are installed as a pack and each has an ammunition box of about 500 rounds capacity.



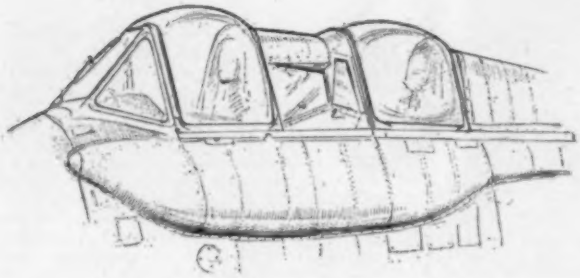


The tail of the Supermarine 525 Naval fighter, seen above, is full of interest. The arrester hook, is covered by doors which incorporate the tail bumper. The lower part of the split rudder is cut away to allow for the very considerable movement of the "all-flying" tailplane, and the bullet fairing houses a braking parachute.

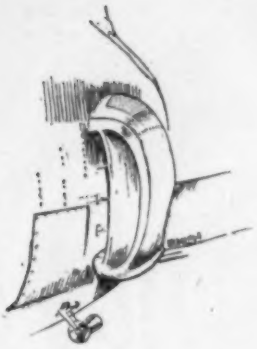


The Vickers-Armstrongs Valiant B.2 displayed vortex generators, or "turbulators," on the fin and on the variable-incidence tailplane, above. It was noted also that the Supermarine Swift F.3 had vortex generators—on the starboard tailplane only. On the left is the tail of the Short S.B.5, showing also the generous tufting on the port outer mainplane. Results are recorded by the camera in the fin. The adjustable tailplane has a movement of plus or minus 10 degrees.

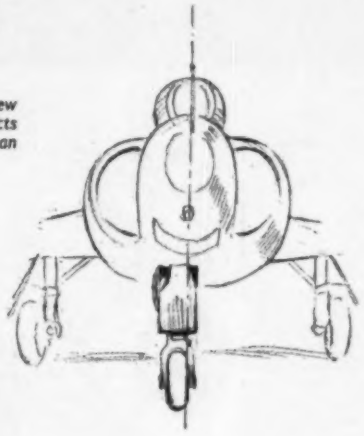
A Miscellany of "Flight" Copyright Drawings

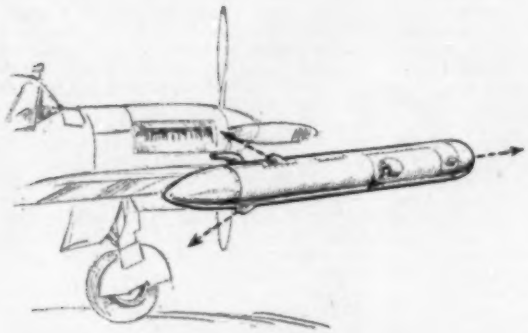


The already lavish transparency of the Fairey Gannet fits it for its new trainer role almost without alteration. The external electrical ducts of the T.2 version, however, are—as seen—considerably larger than those on the A.S.1, the standard operational version.

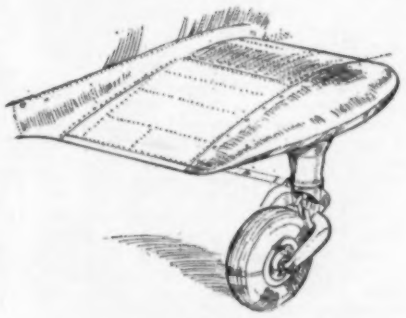


Above is an intake—with bleed—of the Hunting Percival Jet Provost. On the left is a sketch to illustrate the offset nosewheel arrangement of the Supermarine 525, dictated by structural considerations.

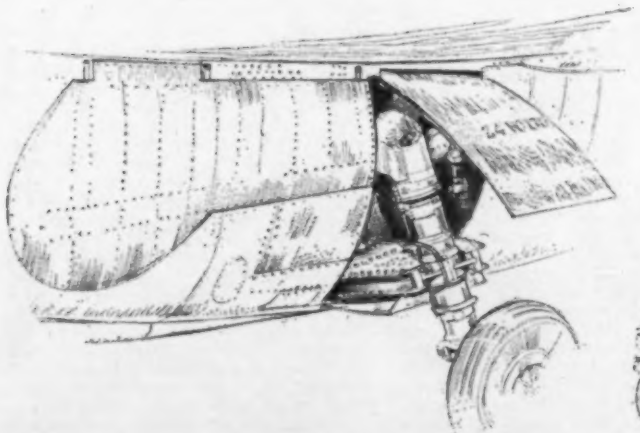


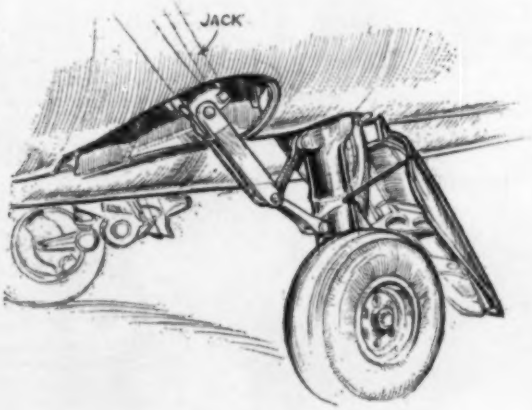


Each wing-tip nacelle on the Fairey Firefly 8 houses no fewer than four recording cameras. This aircraft is designed for use as a radio-controlled target drone, or for observation of guided-missile trials.



These two undercarriage assemblies are, above, that of the Bristol 173 twin-rotor helicopter and, below, of the Folland Midge. On the 173 there is a connecting torsion bar. All three undercarriage assemblies of the Midge are used as air brakes.





The main undercarriage of the Fairey F.D.1 delta-wing research aircraft (above) caused much speculation at Farnborough. In fact, the action is simple: the leg swings outwards and rearwards about a 45-deg hinge-pin to stow behind the fuselage doors. Access panels to the jack, and rack-and-pinion assembly, are below the door. The lateral beam member folds independently.

THE INDUSTRY

An Appraisal of New

THE amount of work that goes into each S.B.A.C. show is truly prodigious; it includes the provision of what is certainly one of the largest temporary exhibition sites in the world. This year the Farnborough static exhibition covered a floor area of a little over 100,000 sq ft; this alone gives a clue to the immensity of the task facing Mr. L. R. Jolly, the S.B.A.C. principal assistant (exhibitions) and his staff. Another and new factor this year was the use of the wholly new site, on Observation Hill. Quite early this spring, contractors were at work plotting out the top of the hill, installing new electrical sub-station and putting down a complicated system of piped water and drainage. A massive, stepped approach was also constructed.

ENGINE AND FUEL ACCESSORIES

B.T.H. Supplementing the considerable number of cartridge starters of B.T.H. manufacture now in use, the company are in full production with liquid-monofuel starters, operating on iso-propyl nitrate. The company state that their monofuel equipment "has been developed to cover the range of all aircraft gas turbines in present use." Another line of development consists of high-energy ignition units; although the discharges from such equipment are delivered at a lower rate than those from a booster coil, each impulse has very much greater energy. Operated from a normal 24v supply, the B.T.H. units are suitable for operation at heights up to 55,000ft and in ambient temperatures between −50 and 100 deg C.

Delaney Gallay. Illustrated on this page is the new fuel-cooled oil cooler, shown at Farnborough for the first time. It embodies a number of concentric light-alloy tubes, the inside tube being the secondary surface. It is suitable for quite high oil pressures (say, 100 lb/sq in) and the fuel side of the cooler has been cleared to accept as much as 1,000 lb/sq in. The whole assembly can be made up into any desired shape, that illustrated being of saddle form for fitting around the compressor case of a gas turbine.

Gallay are also now in full production with Thermoflex, made with the co-operation of the Johns-Manville company of New York. This material is a heat-resisting felt blanket formed between sheets of reflecting and protective metal foil, and various grades and thicknesses are available. Some Thermoflex units are specially tailored to fit around particular hot items, such as turbojet reheat tail-pipes.

Delaney Gallay fuel/oil heat-exchanger.

Dowty. Dowty Fuel Systems, Ltd., exhibited several new items, of which the most important was a completely new twin-unit fuel pump for gas turbines. Faced with demands for increasing delivery, the Dowty pump designers have decided to "double-up" two conventional seven-cylinder pump units within a common casing, so doubling output for much less than twice the weight and bulk. Furthermore, the twin unit has "twin-engine safety" in that, should either pump unit fail, a shear-neck in the drive shaft breaks, a non-return valve in the damaged pump shuts, and the remaining unit can continue to supply a safe working delivery with high efficiency.

Known as Type ENG.450, the twin pump unit has a delivery at 1,000 lb/sq in of some 2,500 to 2,800 g.p.h. at 4,000 r.p.m. (depending on whether petrol or kerosine is being pumped) and a maximum delivery at the same pressure of 3,300 to 3,500 g.p.h. at 5,000 r.p.m. Provision is made for an overspeed governor and a creep control, the latter preventing increase in governed r.p.m. as altitude is gained.

Fireproof Tanks. Although it cannot be stated whether or not this company have their fuel tanks fitted to certain aircraft, models of the Swift, Hunter, Victor and Midge were displayed on the Fireproof Tanks stand.

Hobson. Rather frustratingly, H. M. Hobson, Ltd., were permitted to display a number of their recent developments in control equipment for gas turbines, ramjets and rockets, but were not allowed to section anything or explain how any item worked.

Several of the items were clearly intended for guided-weapon applications, and among the many valves on view was a g.w. liquid valve, a rocket-propellent valve group, a range of non-spilling fuelling valves and a relief valve for corrosive propellents. A low-pressure solenoid valve was another item, this coming into play early in the firing sequence of a missile to control the subsequent triggering of events. Virtually nothing may yet be published regarding British ramjet work, but Hobson showed a ramjet air/fuel control, in which governing was based upon the mass air-flow. Another item, this time for gas turbines, was a speed-governing fuel control, with a centrifugal pump limiting the maximum r.p.m.; this unit was linked with a booster pump, anti-g and cut-off valve.

Lucas. Illustrated in sectioned form is the reheat turbo-pump, which is driven by a two-stage air turbine turning at 25,000 r.p.m. and drawing about 0.69 lb of compressor-bleed air per second. This tiny unit can deliver enormous fuel flows for afterburning periods of up to ten minutes; it is in production for Rolls-Royce turbojets. When reheat is cancelled, all the electrical control units are de-energized, whereupon the air and fuel cocks and the jet-pipe eyelid shutters close automatically.

One of the largest exhibits was a range-temperature control unit (for the late-model Avons, we believe) one of which we illustrated in our September 3rd issue. Hydro-mechanical governors are another Lucas product, and they are proving exceptionally good at their task of ensuring that the maximum governed engine speed is maintained at the same level irrespective of the type of fuel used. Another exhibit was a turboprop jet-pipe temperature limiter in which long quartz rods, with a large sensitive area, are housed in a fairing of aerodynamic shape extending right across the jet-pipe.

Marston. Makers of Flexelite fuel tanks—one of which, for the Viscount, was exhibited—the Marston Excelsior company chose as their most prominent exhibit a 90-gallon laminated plastic drop-tank. Of unusually streamlined form, with a low fineness ratio (i.e., long and slender), the tank was made of glass cloth impregnated with Nuron 100 resin, and the moulding incorporated twin fins. Advantages claimed include low weight, high "nestability" ratio, and high mechanical strength.

Other Marston exhibits included a light-alloy fuel heater for the Viscount and a light-alloy intercooler for a modern jet fighter. The company is also noted later in this review, under the heading "Miscellaneous."

Plessey. In co-operation with D. Napier and Son, Ltd., a high-frequency ignition unit has been developed for all types of gas turbine. There is at the present time a considerable amount of discussion regarding the merits of high-tension and low-tension ignition systems, and we know that the Napier-Plessey unit is considered by its sponsors to be considerably safer than high-tension systems, particularly to servicing crews.

It works off a 24-V D.C. system, and provides a high-frequency high-energy discharge at low voltage; the energy of each discharge is approximately 0.17 Joule with dissipation in 90 microseconds and a repetition rate of up to 40 per second.

Plessey also exhibited the complete liquid monofuel starter for fighter turbojets, this being an iso-propyl nitrate unit complying with the "ten-second" starting requirement laid down for the new fighters for the R.A.F. It has been "production-ized," type-tested and is now going into large-scale production.

ON EXHIBITION

Developments of the Year

Erection of the spacious "hall" itself began on July 5th, and progressed to such effect that, by the 19th of that month, standfitters were laying down the floor platforms for the 292 stands—a task which occupied one week. Electrical teams then came in to fit the huge hall for light and power and were immediately followed by another contractor's crew, who put down the flooring between the stands—heavy Kraft paper covered by an inch-and-a-half of tarmac, rolled by hand. On August 5th, actual standfitting began.

Now the great show is over, and there will very soon be scarcely a trace of it left. During the past two weeks the exhibition building has slowly been disappearing—a three-week job—together with its windbreak wall structure. Seven days will suffice to pull up the tarmac floor and strip down the power and water services and, by the end of next month, all that will remain will be the rising access road, sans flag poles. And early next year, discussions will be held to determine the form of the 1955 exhibition.

Rotax. Last year, Rotax showed the fuel/air turbine starter in the form in which it was originally developed by the Eclipse Pioneer division of the American firm of Bendix (from the Rotax monofuel starter!), but this year Rotax have been able to show a wholly British variation, which should be more flexible in use. Whereas the Bendix starter had all the various components built up into one long unit, the new Rotax fuel/air motor is split up into the motor and remote control units. As a result a long nose-bullet is not required (so making possible the attainment of optimum flow into the engine) and the starter equipment can be tailored to fit any application.

The Rotax stand this year also showed their revised turbine wheel for this starter; previously machined from one hunk of temperature resistant Jessops alloy, the new wheel has separate Stellite blades Argon-arc welded around the periphery of the stainless-steel hub, so reducing production cost and time and probably giving a better life. Other new fuel/air starter equipment included the four-stage air compressor, with air cooling, and delivering at 3,000 lb/sq in to a new form of glass-fibre air bottle.

Rotax have also developed a completely sealed pre-fabricated ignition harness for gas turbines, very resistant to oils, and also probably capable of accepting higher temperatures than could previous harnesses.

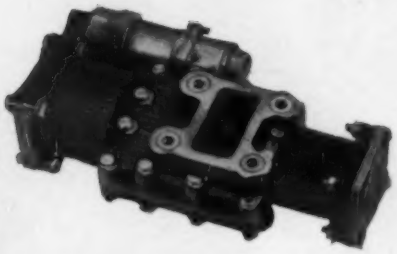
Simmonds. Under M.o.S. contract, Simmonds Aerocessories have modified their existing Pacitor fuel gauge system to suit the new R.A.E. moving-magnet ratiometer, and have produced prototypes of the resulting equipment showing much reduced weight and bulk. A demonstration panel of the new system, known as the Pacitor gauge Type 2, was on view; some of the advantages include the fact that there are no moving parts apart from the indicator pointer, the oscillator output voltage is reduced, faults result in an indication of zero, and provision is made to take up component tolerances—such as variations in tank units. For calibration in terms of volume, provision can be made for re-setting to varying fuel densities, while this correction is hardly necessary if indication is in terms of weight.

Long, trouble-free life seems to be assured by making the components—such as the matching unit—in "potted" hermetically sealed form, used on a disposable basis. The temperature limits for the rectifier units, for example, are ±100 deg C. As an indication of the weight saved by using moving-magnet indicators (some of the first in the country), the 2in-diameter indicator weighs 12 oz; the old 115-volt oscillator supplying two indicators weighed 23 oz, whereas the corresponding 26-volt unit weighs but 16 oz.

Teddington. Most of the exhibits of Teddington Controls, Ltd., were discussed on September 3rd. Illustrated above is a new electro-pneumatic valve which handles hot compressor-bleed air. It has no actuator; instead, the valve is moved by a pair of pistons of unequal diameter connected to the air duct upstream of the valve, and a solenoid-valve can be used to bleed air from the larger cylinder when required. It handles air at 350 deg C and weighs 5 lb 3¾ oz.

Vokes. Specialists in filtration for many years, Vokes showed filters for virtually all kinds of liquids and gases. Equipment is in production incorporating both the felt type of liquid filter and the Mille-vee type of air filter; generally speaking, as gas turbines have gradually supplanted piston engines, so has demand of the felt filter tended to increase and that of the air filter to fall off. Nevertheless, several important new Mille-vee filters were on view, a typical example being the intake filter and housing developed for the Leonides Major powered Westland Whirlwind. This unit incorporates an independent filter element which can be slid out for cleaning.

One of the largest items shown was the filter for Britannia cabin air; several of these cabin-air filters—and those for armament-heating systems—require elements which can resist quite high temperatures. Vokes have also developed fuel filters for the Comet and for the Olympus turbojet, the latter having a special fabric element housed within a Bristol cast body. The demands of the guided-weapon programme have also made necessary the development of very high performance liquid filters.



Teddington Electro-Pneumatic Valve.

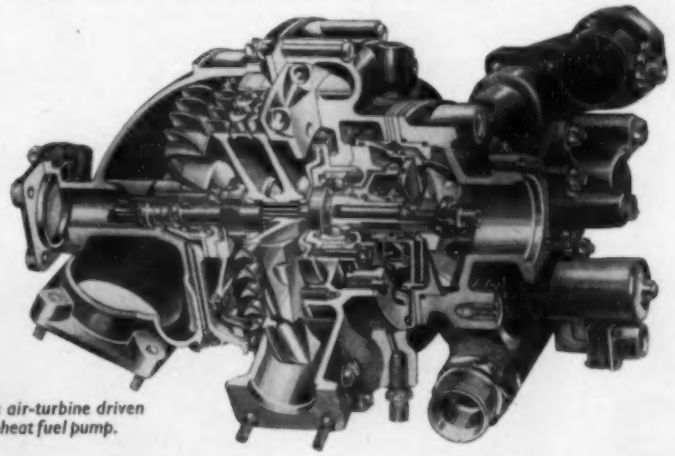
Although such items are not engine accessories, it is worthy of note here that Vokes were able to display a range of air filters for radio and radar equipment (Ekco and Burndept) and hydraulic filters, principally for powered control systems.

ELECTRICAL EQUIPMENT

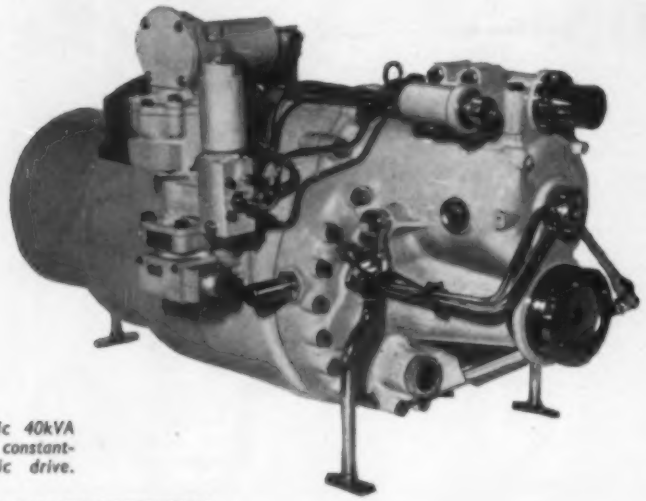
B.T.H. The British Thomson-Houston company exhibited a selection of A.C. and D.C. motors, in which particular interest attached to small induction motors for blower units and radar servo-control circuits. Among the large motors were several employed in flying-control systems. B.T.H. are also associated with the Rover company in the development of completely self-contained gas-turbine-alternator sets, a feature of which is the manner in which the air supply to the engine also cools the alternator.

Burgess. Two hundred different micro-switches were exhibited, the two most interesting being the Switchette and the Mk 5 Universal switch. The former unit has been developed in co-operation with Rolls-Royce, and is suitable for use "inside gas turbine aero engines"; the exhibit was shown working inside an electric oven at 300 deg C. The Mk 5 Universal is an improved split-contact switch, with "floating" moving contacts. As a result the unit can change over simultaneously on both contacts more readily, bounce is virtually eliminated, so reducing arcing wear, and resistance to vibration and high acceleration is greatly enhanced.

Chloride Batteries. Makers of the well-known Exide units, Chloride Batteries, Ltd., exhibited the new 6MNA17,



Lucas air-turbine driven reheat fuel pump.



English Electric 40kVA alternator with constant-speed hydraulic drive.

INDUSTRY ON EXHIBITION...

an unspillable lightweight 12 V, 12 a.h. battery, used for operating canopy-jettison gear, v.h.f. equipment and other services for fast military aircraft. Providing high discharge currents at low temperatures and with high terminal voltages, the 6MNA17 occupies less than 80 cu in, and weighs 4¼ lb with acid. Other new products were the ZVP19 battery designed to operate a vibrator power pack for portable radios and the remarkable three-cell, lead-zinc primary cell developed principally for energizing radar-sonde equipment.

English Electric. One of the principal advantages enjoyed by American alternator designers has been the existence of the Sundstrand variable-ratio hydraulic drive, which can provide, over a wide range of input r.p.m., a constant output speed suited to the alternator concerned. The equipment is completely self-contained and can be mounted on the nose of a turbojet.

Sundstrand have now concluded an agreement with the English Electric group under the terms of which the hydraulic drives are going into production in this country. Development is chiefly aimed at facilitating the introduction of high-power 400-cycle systems, working at 200/115 volts, three-phase. One unit is illustrated, with its alternator; this was the machine principally featured on the English Electric stand.

English Electric also have a range of standard A.C. motors, a very important new 300-amp D.C. generator capable of operating over a speed range of 3.5 : 1, a number of linear and rotary single- and two-speed actuators and a competitive new 500-watt rotary inverter.

Oldham. Many of the Oldham batteries on view at Farnborough were familiar standard types, but there was a completely new 12 V, 25 a.h. unit designed to give greater mechanical strength, lighter weight and improved unspillability characteristics. The example shown was a development model of a design now awaiting official approval. Another battery, capable of delivering peak currents of up to 1,000 amperes, is the Type H unit. This is a 24 V, 40 a.h. battery, originally designed to M.o.S. requirements for the emergency starting of turbojets, and Oldham state that it can handle the largest engines in service over a wide range of temperatures. It is approved for such aircraft as the Pembroke, Gannet and the three V-bombers.

Peto and Radford. Illustrated on this page are two alternative versions of the new 12-ECC13-B battery developed to suit the requirements of all modern military and civil aircraft, including turbojet starting. A 24 V, 25 a.h. unit, the total weight is 38½ lb, complete with acid. The battery was displayed for the first time this year.

Plessey. One of the principal new developments by this company is a series of rotary transformers, of which more than 50 types are already available. Three typical specimens were on view with the following characteristics: input 27 volts D.C., output 600 volts H.T. (±5 per cent) at 500 mA or 50 volts (±3 per cent) at 30 mA, rating 300 watts continuous, weight 12 lb; input 27 volts D.C., output 500 volts ±5 per cent at 360 mA or ±3 per cent at 30 mA, rating 180 watts continuous, weight 7 lb; and a short-life inverter with input 6.3 volts D.C., output 190 volts D.C. ±5 per cent at 220 mA or 190 volts A.C. ±5 per cent at 25 mA, an 800-cycle single-phase machine with a rating of 46.5 watts for 50 seconds and a weight of 1½ lb.

Plessey continue in production with various forms of actuators and they are also co-operating with Triplex in the development of electro-thermal de-icing of glass panels, Plessey being responsible for the control equipment. The heating, which can be by wire or gold-film, is controlled by a magnetic-amplifier unit which governs pre-heating, normal operation and also has a separate emergency control to limit the panel temperature to 70 deg C. The supply is 115 V ±5 per cent, 400-cycle ±5 per cent, the consumption 6 VA, and the weight 4½ lb.

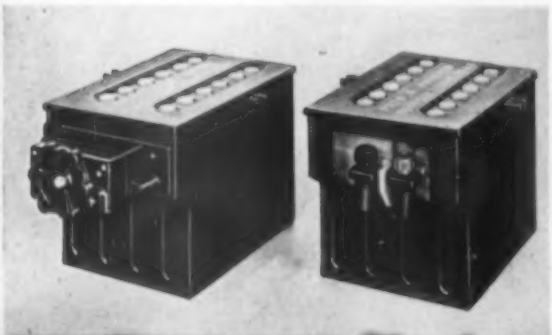
Rotax. The Rotax company have now built up a complete integrated range of standard actuators, which are in production for powering such important services as basic flying controls and trimmers, air brakes, tabs, engine controls, landing gear and flaps. Of the flying control actuators, A.1603 is particularly important, while EXP.3926 is a recent flap motor, in which the box is mounted in the fuselage and drives separate flap-drive shafts along the wings. Another new flap motor is C.8501, illustrated in our issue of September 3rd.

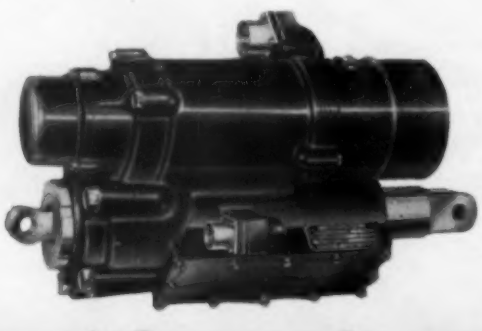
Development in D.C. generating systems includes a new 6 kW generator which can be operated at any speed between 2,860 and 10,000 r.p.m., on a 28 V regulated system. Another new generator is the EXP.5066 with a rating of 3 kW. Weighing only 27 lb, this blast-cooled unit has a full-load speed range of from 8,750 to 13,100 r.p.m., and can operate at 60,000ft. The normal delivery is 100 amp at 28 V.

Considerable development is also taking place in A.C. systems. The big 75 kVA machines are now being up-rated to 130 kVA by clearing them to run at a constant speed of 8,000 r.p.m. Rotax are also developing self-contained A.C. alternator sets driven by Rover or Turboméca gas turbines. With the 60 h.p. Rover turbine, driving at 8,000 r.p.m., a constant-speed 30 kVA machine can be re-rated at 40 kVA; even at 60,000ft altitude, the set can still be run safely with a load of, say, 15 kVA.

Salford. A subsidiary of the General Electric Company, Salford Electrical Instruments have developed a new aircraft circuit breaker known as the Klixon. Manufactured up to a maximum rating of 50 amp, the Klixon provides thermal protection by means of a bi-metallic strip; it can be manually opened or closed but, once it has operated thermally, it cannot be reset until it has cooled. The wide open-circuit gap ensures the high rupturing capacity required in heavy-duty systems; the weight is under 2½ oz and the Klixon is highly resistant to shock and to adverse climatic conditions.

Venner. On the stand of Venner Accumulators were several new types of lightweight silver/zinc batteries. One of the most valuable basic units is the SZ/6/12, made up in standard 6 V units in five-cell series (each Ag-Zn-KOH cell is nominally 1½ V, but five are used owing to the high loading). The rating of SZ/6/12 is 120 amp-min at 6 V or 60 amp-min at 12 V; one exhibit showed a unit made up into a complete power pack for a guided weapon, fitting neatly into a body of about 8 or 9 inches diameter. Another recent cell is the H40/24 as employed on the Midge. This is a 40 amp-hr, 24 V battery, and it was also displayed on the Folland stand with a placard giving its weight as 24 lb, in contrast to the 70 lb of a conventional 24 V lead-acid accumu- of a conventional 24 V lead-acid unit.





Rotax A.1603 flying-control actuator. Far left, two forms of a new Peto and Radford battery.

Western Manufacturing. Manufacturers of a wide range of equipment, this company showed a selection of actuators, and such items as two-speed trimmers and a stall-warning control-column vibrator. Among the many motors on view, we have selected one for illustration on this page. It is the PME 100 Mk 1, a permanent-magnet motor suitable for use in guided weapons or airborne radio and radar systems. The output was plotted as a curve on the Western stand from which we selected the value of 1.5 in-oz at 2,200 r.p.m. on a 25-volt system.

HYDRAULIC EQUIPMENT

British Messier. In addition to displaying undercarriages for such diverse machines as the Midge and Britannia, this company showed a number of new hydraulic units. One, coupled to a Rotol electric motor, is the Type 4853 pump which supplies 4,000 lb/sq in Skydrol 500 non-flam fluid for the Britannia 300; there will be four such motor/pump units to each aircraft, and the motor is rated at 9 h.p. (20 minutes) at 10,000 r.p.m. Also running at 10,000 r.p.m. was the Type 4839 lightweight two-stage pump, delivering 15 cu in/sec at 4,000 lb/sq in.

Electro-Hydraulics. On the joint stand occupied by Electro-Hydraulics and Rubery Owen (both members of the Owen organization) was displayed a neat motor-pump hydraulic power unit for autopilot operation, of a pattern now in quantity production against M.o.S. contracts. Power was drawn from a ¼ h.p. B.T.H. motor, which was coupled to a single-stage gear-type pump delivering up to 2¼ cu in/sec at a delivery pressure of 1,000 lb/sq in. Magnesium alloys were extensively used in the construction of the main assemblies, which no doubt assisted in keeping the total weight (including the motor) at the competitive value of 20½ lb.

Lockheed. With their associated company Automotive Products, Ltd., Lockheed had something on every aircraft at Farnborough. At one end of the scale, there was the manual hydraulic system (described in *Flight* of September 3rd) used to lower the flaps on the Auster A.O.P.9; at the other, Lockheed supply the entire hydraulic system for the Comet 3, including main and nose undercarriage jacks and door actuators, nose gear steering, flap jacks, air brake jacks and Servodyne flying controls. The Comet 3 has separate inner and outer flaps, unlike the Series 1, and the flap actuators are of the Servodyne type, capable of setting at any position.

One of the company's exhibits was what is believed to be the first high-capacity silent hydraulic cut-out valve, which virtually eliminates banging (hydraulic shock) throughout the system; it is specified for Viscounts and Beverleys. Most of the company's hydraulic systems are driven by the familiar Mk 7 and double-capacity Mk 8 pumps (both are on Comet 3), and the Mk 7 is used on the Folland Midge, together with cut-out, accumulator and selector. Also on the Midge are some very attractive selector valves arranged in series with universal joint connections. A point of particular interest is that no seals are now employed on Servodynes and other Lockheed units, which are rendered pressure-tight by having lapped plungers, with a close-tolerance metal/metal seal.

Venner SZ/6/12 lightweight battery power pack in missile body.

Plessey. A largely self-contained hydraulic power pack has been developed, intended to perform one or more vital operations following complete failure of the main hydraulic system. Driven by an electric supply (we see no reason why it should not work equally well off a ram-air turbine), it operates at 4,000 lb/sq in at which pressure the delivery rate is up to 1.34 gallons per minute. Fluid is drawn from a separate reservoir in which the level is maintained by the main circuit.

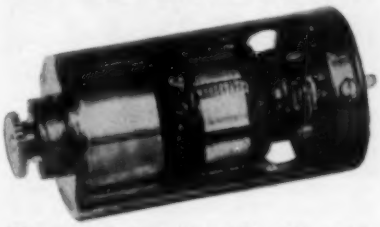
Plessey also exhibited an hydraulic pump which had been stripped after a long and arduous laboratory test at high pressure. One of the most rugged Plessey pumps is the 2H-10 unit, which has been used by the guided-weapons hydraulic laboratory of the R.A.E. This pump has successfully completed a 500-hr test cycling at 10 sec on-load at 4,000/5,000 lb/sq in and 10 sec off-load, at 2,880 r.p.m. using Shell Tellus 27 fluid. Another single-stage gear pump is the AH-55, cleared for use with non-flam fluids such as H-2 and Skydrol. This pump has several notable features, including self-aligning journal bearings and separate independent side-face bearings which adjust automatically to prevent losses and so maintain a high volumetric and mechanical efficiency. AH-55 delivers up to 20 gal/min at 4,000 lb/sq in at 4,000 r.p.m. and weighs 18.5 lb. It provides 3 fluid horse-power per pound of weight.

PNEUMATIC EQUIPMENT

British Emulsifiers. Mr. F. G. Miles and his colleagues now have interests in a number of associated enterprises, including British Emulsifiers and Jet Tanks, Ltd. It was the former company whose name appeared above a stand at Farnborough, and a variety of moulded plastic developments were on show. Some of the largest were phenolic-asbestos pressure vessels, some with marks of 30 mm gunfire to show the absence of any tendency to shatter. Another development was a spring-fitting access door in a high-pressure moulded plastic container.

The most advanced practical item, however, was the Mk 5 Miles reinforced plastic air bottle, built up from glass rovings, with a free-flow ¾in connection orifice and a threaded mounting boss at the base. With a diameter of 12¼in (external), the bottle shown had a weight of only 16½ lb, representing an air-to-bottle weight of 1 : 1.9, for 8¼ lb of air can be held at 3,000 lb/sq in. The bottle has been tested to 6,000 lb/sq in and can operate at temperatures up to 225 deg F. It is stated that these bottles, also, do not shatter when pierced by gunfire.

Dunlop. The development and mass-production of pneumatic equipment for guided weapons is playing an ever-increasing part in the activities of Dunlop's aviation division. This year the company have been able to display one or two selected items from the huge range already available, several of the units having been developed directly from equipment originally produced for piloted aircraft. One of the most difficult requirements is to provide a constant supply pressure from an air bottle in which the internal pressure falls away as air is consumed. Dunlop missile pressure-reducing valves provide such a constant pressure, and some are designed to fit into the bottle. Other g.w. units include electromatic solenoid-operated valves roughly 2in by 1½in square and a 4,000 lb/sq in air filter about 2in high by 1½in in diameter. Most of these items have to be capable of withstanding very high acceleration and vibratory loads.



Western Manufacturing PME 100 motor.

Dunlop have developed a range of resin-impregnated glass fibre air bottles, capable of storing air at the highest projected pressures for aircraft pneumatic systems. Of spherical form, these containers have a strength/weight ratio better than that of metal bottles, and other advantages claimed include less strength "scatter," complete absence of grain flow, resistance to weathering and temperature change, good fatigue life and lack of fragmentation following battle damage.

Other new Dunlop pneumatic equipment includes an improved inflatable canopy seal and a cocking unit for the Aden 30 mm gun, the latter comprising a pneumatic ram fixed to the gun to which a servicing crew can clip a high-pressure ground air supply to cock the weapon.

Electro-Hydraulics. This company are devoting a great deal of attention to the development of pneumatic systems which can be operated, with great reliability, in high ambient temperatures. As practical evidence of their progress, the principal pneumatic exhibit was a demonstration rig of a specimen jack actually operating within a Wild Barfield electric furnace at a temperature of 400 deg C. The jack had already completed 15,000 reversals at a high pressure when the Show began. It was cycling at about one reversal in two seconds throughout the week. Another exhibit was a standard bleed valve for an early production type of Rolls-Royce Avon, together with its associated control unit.

Hymatic. High-pressure reducing valves are one of the most important Hymatic products, with input pressures ranging up to 4,000 lb/sq in and outputs anywhere between 20 and 2,000 lb/sq in. These valves are in production for all kinds of gases, fuels, oils and water-based fluids. Of electro-pneumatic valves one of the most interesting on view was the

Electro-Hydraulics' Victornose undercarriage.

INDUSTRY ON EXHIBITION...

MD.25, which handles the sort of flow required by fuel/air starters. This valve accepts air at 3,000 lb/sq in working pressure, with a flow rate of as much as 1 lb/sec; the pressure drop is, nevertheless, extremely low, and the weight is 1.6 lb.

A whole range of snap-jacks and similar one-shot units was on view, these being made up either as a simple bottle and bursting diaphragm, or as a bottle and valve or as a complete system, with operating pressures up to 4,000 lb/sq in.

A wholly new item was the PSC.1 series of quick-disconnect sockets for pilots' personal services. A single, multi-socket attachment is provided to handle oxygen, anti-g line, piping to a pressure or ventilated suit, radio, electric heating and other services. All can be plugged in or disconnected together, and without a moment's delay.

UNDERCARRIAGES

Dowty. Although the Dowty Group exhibited a number of complete undercarriage units, it was a model that attracted the greatest interest. The exhibit showed a tandem-wheeled main undercarriage unit with controlled articulation designed to retract into a thin wing. The wing—which had a thickness/chord ratio lower than that of any wing now flying in this country, besides having considerable sweep—was mounted fairly high on a slab-sided fuselage, and we gather that the undercarriage was, in fact, one actually prepared for a projected aircraft design. The gear was mounted on a single sideways-retracting leg, and consisted of a single bogie beam on a shock-absorbing leg and carrying, in its turn, a pair of wheels mounted in tandem *à la* Valiant. The beam was so arranged that, in the free position, the front wheel hung lower than the rear, and consequently touched down first; damping was provided by an auxiliary cylinder at the rear. The model illustrated the controlled articulation by dropping the assembly on to a moving belt; mechanical and working details were made by Dowty apprentices.

Other Dowty undercarriages included the main units for the Vulcan, Javelin, Hunter and S-14, the tail unit of an Aiglet (to show the smallest Liquid Spring application) and both main and nose twin-wheel units of an Avro Canada CF-100.

Dunlop. One of the most successful items by Dunlop's Aviation Division continues to be the Maxaret non-skid brake unit, demand for which is rapidly assuming huge proportions. Development of bag-type drum brakes and plate brakes, together with their associated wheels has continued; in the field of tyres, the emphasis is strongly towards the new dimpled tyre, even on narrow high-pressure tyres for fighters. Tyre strength and inflation pressure is also being steadily pushed up and both are already several times what they were during World War 2.

Electro-Hydraulics. The principal exhibit was the complete nose undercarriage of the Handley Page Victor, so arranged that it could be power-steered from a remote console. This unit has twin wheels on a single leg carried on a strut which is free to rotate within the large and rigid cast body; at the top end of the leg are a pair of 4,000 lb/sq in jacks tied in with the main retraction circuit which, according to the difference in phase between the pilots' steering wheel and a mechanical follow-up, steer the unit, or leave it free to castor. The jacks also centre the unit for retraction and act as a built-in shimmy damper.

On the joint Electro-Hydraulics/Rubery Owen stand were a number of other landing gear exhibits, including a complete Canberra main leg and fairing door.

Girling. A new, and very attractive, form of disc brake has been developed for all types of aircraft up to a weight of about 11,500 lb. All the brakes are of generally similar design, although patterns are available with one or two discs and one or two calipers. The units can be operated by any hydraulic or pneumatic system of the appropriate pressure.

The discs are arranged to float axially on a splined shaft, and the segmented friction pads are mounted on one or two caliper units, wear being automatically taken up. Advantages claimed for the brake include light weight, absence of fade and easy dismantling—the latter point being typified by the fact that only two pins need be removed from each caliper to withdraw the associated friction pads. The Girling exhibit was a hydraulic twin-caliper brake for an 11,500 lb aircraft, with the following performance: static braking torque, 29,300 lb-in; energy absorption capacity, 1.61×10^6 ft-lb.

Goodyear. Both in Great Britain and America Goodyear factories are in large-scale production with several very advanced forms of landing gear equipment, much of which was discussed in our issue of September 3rd. Illustrated opposite is the brake of the Republic F-84F Thunderstreak supersonic fighter (American) which was described at Farnborough as having the maximum k.e. capacity for a given space. It is housed entirely within the wheel, the latter being no more than a rim.

Lockheed. The associated companies of Lockheed and Automotive Products exhibited an encouraging amount of new equipment. In the field of landing gear development, Lockheed did the prediction and stressing upon which the de Havilland undercarriage of the Comet 3 was based, and the main gear of this aircraft was exhibited. Compared with earlier Comets, it has a cleaned-up exterior, and the main leg is now made in one large piece. The main shock strut was displayed as a separate exhibit, and this, together with the rebound damper, can be removed without disturbing the remainder of the bogie. Another Lockheed undercarriage is that for the Sea Venom, this being stressed to accept the considerable weight of these all-weather machines landing at the rate of descent specified for carrier operation. The leg has a long stroke, and is arranged to shorten before retraction. The basis is a light-alloy forging. Probably this undercarriage will be the last of the long line of Vampire and Venom units produced by Lockheed during the past 10 years.

MATERIALS AND FABRICATED COMPONENTS

Accles and Pollack. This well-known tube-manipulating company were proud to display a specimen of cold-drawn seamless titanium tubing.

Avro. At Manchester, considerable research has gone into the development of efficient structural honeycomb materials, and—according to an overseas journal—they will find an important application in the forthcoming light delta-winged ground attack machine which has been designed to the requirements laid down by NATO. Be that as it may, Avro showed at Farnborough that they have a great knowledge of honeycombs, and most of these are built up of 0.003in honeycomb sandwiched between any gauge of skins. Araldite bonding, sometimes aluminium-filled, is employed.

For machining the honeycombs to the required thickness, the hexagonal interstices are filled with soft wax, so producing a core sufficiently rigid to prevent buckling of the individual "three-thou" walls; after cutting away, the wax is simply melted out. The result of the technique is that honeycombs can be used for really sharp-edged aerofoils; this was exhibited, as was the use of the method in shear attachments, test specimens and other forms. Most of the honeycombs were of half-inch thickness.

Two basic forms can be made: the standard hexagon, which can only be bent into two planes, and the staggered honeycomb, rather like a brick wall in form, which can be bent in all three planes. An example of the latter showed the core alone used as reinforcing for a hemispherical bottle.

After the first flight of an aircraft with a honeycomb skin, some form of test is necessary to determine whether any parting of the skin from the core has occurred. Avro have developed a very simple pneumatic suction-cup device, which is allowed to adhere to the portion of the skin under investigation. Powered electrical probes then descend on to the skin with a known force and, depending on whether the honeycomb is still sound or not, green or red lights flash. The equipment can work on plane or curved surfaces without re-setting, and the sensitivity is such that a fault of 1in diameter can be detected on 12-gauge skinning. The chief advantage is, however, the speed with which it can cover big areas—even the wing of the Vulcan would not be too much to tackle.

Birmal. One of the principal exhibits on the stand of Birmingham Aluminium Casting (1903), Ltd., was the massive intake casting for the Proteus turboprop, which includes the discharge holes from the combustion chambers, owing to the reverse-flow layout of the engine. Cast in D.T.D.708 magnesium-zirconium alloy, the unit weighs 155 lb.

Essex Aero. Many of the larger exhibits by this company were magnesium-alloy components for the Beverley. Airframe units included the frame for the large window under the nose, incorporating a flat panel for aiming parachute drops. This frame has had to be made very strong to accept ditching loads, and the construction is of extruded T and L sections in D.T.D.142 varying $\frac{1}{2}$in to $\frac{1}{4}$in

thickness, formed and Argon-arc welded to make a single structure 5ft 9in across and weighing 24½ lb.

The company's sandwich construction continues to progress, and a project exists for this type of material to be used in the Beverley floor. Typical performance is acceptance of a pure compression load of 1 ton/sq in, with bakelite-type bonding between the 24-gauge cups and 20-gauge skins.

Firth-Vickers. In company with at least a dozen other firms, Firth-Vickers Stainless Steels, Ltd., this year concentrated on providing a sales advice service, rather than on showing examples of their work. There was a display, however, in which prominence was given to the latest developments in creep-resisting steels, numbers 448 and 507. The former is supplied in all standard forms, especially for turbine discs; 507 is a new ferritic steel particularly suitable for cast components operating at high temperatures.

Fibreglass. Fibreglass reinforced plastic products have progressed enormously during the past year, particularly in the aircraft industry. No longer are these materials confined to ducting or simple airframe units such as fin tips; this year the company showed compressor blades, airscrew spinners, pressure bottles and other units. The blading had a tip diameter of 14in, and was manufactured from Fibreglass diamond mat bonded with polyester resin, and finished with a phenolic lacquer, by Cambridge University's Department of Engineering. The rotor blading was tested at up to 4,500 r.p.m., and Fibreglass state that "the stator blades were tested in the compressor at 6,000 r.p.m. and air velocities of up to 200ft/sec were observed." The air bottle was associated with a turbojet starter system, and was moulded from Fibreglass roving with epoxy resin. The airscrew spinner was of the type used on the Beverley, and the example shown had, in fact completed 90 hours' flying. Woven Fibreglass cloth is used, moulded by the vacuum bag technique.

Garringtons. One of the largest European suppliers of gas-turbine blades, this company exhibited precision-forged blading in stainless steel, nickel alloys, aluminium alloys and titanium.

Jessop. William Jessop and Sons, Ltd., exhibited all that might have been expected in the way of products in their high-temperature, austenitic and ferritic steels, including gas turbine rotor discs and blades, and nozzle guide vanes, forged or precision cast in all their more recent alloys. Of particular interest, however, was the fact that their stand housed one of the largest hunks of titanium metal that the writer has yet seen in this country.

While they do not intend to enter into the production of titanium in this country, Jessops intend to take in sponge and fabricate the metal and its alloys in sizes suitable for the needs—as now visualized—of the whole aircraft industry. Stock suitable for forging will be produced, as will blading, or bright bar for blade production. In co-operation with a prominent American producer, the company intend to establish a new plant from which full production may be expected in 1956. Considerable experimental work has already been undertaken, and the Jessop stand showed, as we said, a large piece of bar stock, about 2in in diameter, and an equally massive claw for a deck-arrester hook.

Goodyear dual-bearing internal brake.

Kent Alloys. Two of the largest exhibits on this company's stand appeared to be for Flight Refuelling, Ltd., as they were named as the side support casting for a hose reel unit and half a hose drum. Both were sand castings in magnesium-zirconium alloy. A selection of shell moulding was also shown, together with various casting exhibits in D.T.D.304 and L-53. A brake housing for Goodyear was one of the exhibits in die-cast magnesium alloy. There were no parts of missiles this year.

Omes. One of the world's principal designers and manufacturers of electro-upsetting and electro-forging machines, Omes are also in mass-production on gas-turbine blading in a number of materials. The company's stand displayed blading in titanium alloys, Nimonic 90 and 95, aluminium bronze and stainless steel, together with sections of an integral-bladed rotor forged in Nimonic 90.

Redwing. One of the principal developments by this company is their hot-forming process for high-tensile magnesium-zirconium alloys. The patented process consists of pumping a liquid from a thermostatically controlled hot bath in which the material is soaked, and passing it through the tool. A paraboloid exhibited together with a light-aircraft fin were both produced by this technique to very close tolerances.

Joseph Sankey. The insides of our latest turbojets remain, for the present, secret, so this company had to content itself with displaying the complete annular combustion chamber, inner flame-tube, "walking-stick" vaporizing burners and exhaust cone of the Viper, together with the centre casing, cans and discharge nozzle of the Ghost. An array of other, larger, flame tubes were also noted, as was a spinner for the de Havilland contra-rotating airscrew as used on the Shackleton.

Smith's Stampings. Among many examples of drop forging on view were a compressor disc in MAT.206, an undercarriage leg in 4S.11 steel, guide vanes and rotor wheels in S.62 and various Nimonic blade blanks.

Sterling. Although no ZT-1 components were on view this year, the stand of Sterling Metals, Ltd., displayed very advanced castings in several other new alloys. Typical examples were the intake casting for the Eland turboprop, in RZ-5, complete with welded oil-cooling/de-icing jackets, a cast box—presumably for a Rotol accessory gearbox—in ZRE-1, the casting for a Vulcan nose undercarriage, in Z5Z, and a very rigid engine casting in acicular iron.

J. Stone (Charlton). Readers of our April 30th, 1954 issue will have noted the form of the crankcase for the Napier Nomad compound engine. Some 4ft 6in in length, it poses quite a challenge to the founder, and Stones sand-cast it in D.T.D.748 magnesium-zirconium alloy, the finished job having a weight of about 150 lb. An example was on view at Farnborough, together with the frame of the canopy of the two-seat Venom. The R.A.F. and R.N. Venom night fighters have a canopy which resembles that of the Vampire trainer but is rather smaller, since pilot and navigator sit staggered (in the Vampire Trainer, instructor and pupil sit side-by-side). The Venom frame is cast as a single unit in D.T.D.748.

A particularly noteworthy series of exhibits consisted of radar wave-guides, sand-cast in light alloy, bronze or other material, with the interior stabilized by a plaster core. Each exhibit was sectioned to show the finish of the core, and in many cases the form of the component was such that no internal machining would have been possible. According to the size of the unit, the tolerance on the interior passage varied between 0.001in and 0.005in.

MISCELLANEOUS

Avica. These progressive specialists in flexible-pipe assemblies can now meet most of the hottest specifications for such equipment, and rubber has been completely eliminated from all their hoses. The basis of most of their pipe is an inner tube of 18-8 stainless steel, normal or stabilized, which is helically convoluted to form an immensely strong very light flexible hose with a thin wall.

In such a thin-walled tube, welding or brazing would burn or otherwise weaken the wall, and Avica have eliminated such jointing by developing completely mechanical end assemblies. These are completely leakproof at high pressures and temperatures, as has been shown by pressure testing at 1,000 lb/sq in in furnaces at cherry-red (1,000 deg F) temperature. A particular problem is avoiding inter-granular corrosion by the application of brazing or welding temperatures to the tube; for extra-high pressure the hose can be wire-braided, and the fluids or gases which can be passed include all those normally met, including fuming nitric acid.

Avica also make bellows assemblies from sheet stock, which is wrapped, butt-welded and then stiffened with annular convolutions introduced hydraulically.

Avro. On the Avro part of the Hawker Siddeley stand was a fine model of their new universal structural testing frame, shown with a Vulcan under examination.

The aircraft is supported in the zero-gravity condition by counterpoising, this being achieved by independent hydraulic jacks operated at a constant pressure of 500 lb/sq in, with a total lifting capacity of 54 tons. A single control then applies the required test load through other jacks working at 3,300 lb/sq in, with a maximum capacity of 470 tons. The applied load is measured by checking the pressure with pendulum dynamometers and using load-measuring rings as a cross-check. The overhead structure is made of rolled steel sections and weighs 41 tons.

The reaction is transmitted to earth through floor beams weighing 88 tons mounted on 104 reinforced concrete piles each able to take 15 tons in compression or tension.

Another Avro exhibit was a supersonic yaw-vane designed for mounting on the standard probe attached to experimental high-speed aircraft. Weighing but 3 oz, the new vane can replace two standard units which total 26 oz. The vane incorporates a supersonic temperature probe.

Kelvin Hughes periscopic drift meter.

INDUSTRY ON EXHIBITION...

Bowden. Among the varied array of wire mechanisms and complete pipe units displayed by Bowden (Engineers), a particularly important development was the new range of Bowdenflex reinforced plastic pipe units for suction, low, medium and high pressures. These units incorporate the company's patented Series 2,000 coupling with lip seal and wire braid interlocking. The resulting combination has produced a range of piping capable of handling all kinds of gases, acids, alkalis and other fluids, while offering very high resistance to vibration, abrasion, and capable of operation at usefully high temperatures and pressures.

R. A. Brand. Well known as the holders of such familiar trade-names as "Cocoon" and "Koon-kote," Brand's chief exhibit was a complete Armstrong Siddeley Mamba 6 turboprop (for the Seamew, the placard announced) protectively wrapped in a "Texicoon" envelope. There are several types and strengths of Texicoon, but all are sprayed-on plastic coatings fitted with zipper seals, so that each envelope can be stored and used several times.

The Mamba was wrapped in the new Super Texicoon which has been developed to have a phenomenally low moisture vapour transmission rate under the most adverse conditions of the standard tropical test. The complete cover for the Seamew engine-change unit weighed about 35 lb, and was fabricated to a new standard. Vinyl-based solutions are now considered the best for the sprayed-on film.

Graviner. One of the principal developments in aircraft fire protection is the continuous resetting detector initially developed by the Ministry of Supply and displayed by them at the last S.B.A.C. show and also by the Graviner Manufacturing Co., Ltd., who have further developed the equipment as "Firewire" and put it into production. This year, Graviner have been able to show the Series 3 Firewire, in which the main relay box is cast, and is made up as a hermetically sealed unit (the interior units are, in any case, fully tropicalized). Firewire has become widely accepted, and Series 3 equipment is now being produced for the Comet 3, T.C.A. and T.A.A. Viscounts, and other aircraft.

Kelvin Hughes. A particularly bold, and heartening, innovation by the Smiths Group was that on each of the stands of the Group members—Smiths, Kelvin Hughes, K.L.G. and Waymouth—was a series of simple graphs illustrating how the companies had fared during the period 1946-7 up to 1953-4; the subject headings were "growth in aviation production," "growth in floor space" and "growth in number of employees."

Most of the new items developed by Kelvin Hughes were described in our issue of September 3rd; illustrated on this page, however, is an instrument which has not previously been discussed. It is a periscopic drift meter principally developed for pressurized transport aircraft. In addition to determining drift, it can provide an immediate indication of ground speed. The latter is obtained by controlling the speed of movement of a graticule across the field of view, driven by a constant-speed motor through two variable-ratio gears. One gear is used for injecting altitude information and the other for reading off the ground speed. A line control can disengage the graticule from the drive motor so that the graticule can be set to any point in the field.

The drift meter is carried in a permanent mounting in the inside of the fuselage skin, and the instrument is retractable but not normally removable, since it forms a seal for cabin pressure. When in use it projects some 3in from the fuselage.

Kidde. The Walter Kidde company had a number of interesting things to show, particularly notable being the pre-packed dinghy stowage equipment. In this development, the folded dinghy is housed in a light-alloy pannier which is, in turn, housed in a suitable part of the aircraft. The whole is closely integrated and sealed by a transparent lid which cannot be locked home until the whole dinghy and pannier are correctly secured. The dinghy is released by a carbon dioxide cylinder either by remote actuation or by the company's sea cell device. The unit can also be released locally, without inflation, if desired. The whole equipment has been adopted for the Beverley, this aircraft having a pair of 20-man dinghies in each wing.

The sea cell, mentioned above, is a foolproof device intended to trigger any desired service following violent deceleration in water, as for example following ditching. The signal is at present a current strength of 7 amps at one volt, but this can be varied to suit the application. Another recent Kidde product is a very light and compact oxygen breathing set, designed for use, as required, in pressurized aircraft flying at great heights. The cylinder capacity is 120 litres and the filled weight of the complete unit only 2 lb 12 oz.

Lucas. A range of de-icing and space heating equipment has been developed for a number of aircraft, typical applications being Britannia tail anti-icing and both ice-protection and space heating on the Beverley. Outputs range from 2½ to 4 therms per hour for anti-icing heaters and from ½ to 4 therms for space heaters; these high-efficiency units burn kerosine or other aviation fuels, and each unit has an automatic timed starting sequence and a variety of safety devices. In each case the combustion gases are passed through a heat exchanger and led away, while fresh warm air is used to perform the service required. Weights vary according to size, but the 4-therm shells weigh some 109 lb.

Lucas also manufacture a variety of high-temperature bellows in various materials including Nimonic alloys. Solid drawn in smaller sizes (for interconnectors and similar applications), these bellows are wrapped and welded in larger sizes, and they find non-aeronautical applications — atomic energy work, for example.

Marston. Already mentioned in connection with their fuel-tank and other engine-accessory equipment, Marston Excelsior had on view a variety of plastic dielectric radar aerial covers, including the complete nose-cap of the Hunter and the cover for the Durestos flush fin aerial of the same aircraft, a Swift hood fairing in Durestos, reinforced with "ribs and stringers," the nose-cap of the Swift and the cover for the tail-warning radar of the Canberra. Among the metal exhibits were a light-alloy magnetron valve cooler and a light-alloy radar cooling cylinder.

Redwing. An eye-catcher on this stand was a Triplex booster unit for guided weapons of the ground-launched type. The original type of boost for this missile had four motors housed in a separate structure with four fins. The Triplex arrangement has three rocket motors employed as structural bodies, and the weight saved has enabled one motor to be discarded. A tunnel model was shown, of Redwing design and manufacture, but the "performance and intention" of the missile remain secret.

Rotol. In association with the American company of AiResearch, Rotol are actively developing a range of air-turbine drives for production in the near future. One standard turbine is the AT.1/1 rated at 100 h.p., and another unit on view was the ram-air turbine for supplying emergency power to a hydraulic system. This unit will go into production, with a Rotol pump, for powered flying-control stand-by purposes; it gives 3 h.p. at all speeds between 130 knots and Mach 1.

Thermal Control. Probably the principal British suppliers of pressure switches, Thermal Control, Ltd., displayed a variety of equipment, prominent among which were several low-pressure switches capable of operation at huge overloads. A typical example is a switch which, although having a normal operating range between 0.4 and 10in of water, can accept an overload value of 20 lb/sq in. Differential pressure gauges are another product, these being in great demand for such applications as the control of fuel transfer.

Tiltman Langley. Among several new developments, or systems under examination, by electrical remote control if necessary, are a special clutch mechanism, capable of very rapid operation, while operating in a confined space under arduous conditions. It is a positive-drive, double-ratchet unit, capable of being clutched in or out in one-twentieth of a revolution under a torque of 3 lb-ft at speeds between 50 and 300 r.p.m. The overall size is 1½in diameter by 2in length. Another clutch, using rollers, can operate at 500 r.p.m. at lower torques.

Other Tiltman Langley exhibits concerned actuator testers, vibration testers for from 20 to 250 cyc/sec, and the Hayes infinitely variable ratio transmission, in which the output speed is—in the unit shown—maintained at 8,000 r.p.m.

T.K.S. Now owned by the newly formed Kilfrost Manufacturing company, T.K.S. are actively developing porous stainless-steel panel distributors of de-icing fluid. Compared with the sintered bronzes and like materials previously used, stainless steel gives a lighter and more rigid panel in a thinner gauge, besides being more resistant to erosion and corrosion. The de-icing fluid for such panels has to be free from impurities which might block the tiny panel passages, and a range of Micro filters was also on view. T.K.S. also showed a number of metering pumps and pipe-lines, all of which had been internally treated with a durable and chemically inert lacquer to prevent electrolytic or other corrosion.

Triplex. On view were a number of advanced forms of electro-thermal de-icing protection for transparent areas. In addition to a number of exhibits demonstrating heating by means of embedded wires, Triplex displayed the use of 0.0000002in gold film as a heating element, one popular rig having a red filament lamp kept alight by means of such a film. Triplex intend to produce gold-film glass up to 3½ft by 2ft.

A typical current intensity for de-icing purposes is 900 watts per square foot, while 150 watts suffices for demisting purposes. The associated control has been developed with the co-operation of Plessey.

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This Horrible Horse, said the M.D. with a pained expression on his face, is one of the worst examples of the mock-modern school of art. Note the hole where the haybag should be. Note the Desoutter Power Tool hanging inside it. Words fail me. The sculptor (foolish fellow) has got things the wrong way round and inside out. In the best modern art, which flourishes at Desoutter Hendon, the *horse* goes inside the *Power Tool. And* a much more useful, decorative and (if I may say so) lovable horse than that!

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CREW COMFORT

—*and Safety: Some Farnborough Exhibits Studied from a Pilot's Point of View*

THE crew's well-being, both physical and mental, is an essential factor in the efficiency of any fighting aircraft. Recent aeronautical developments have made it necessary to provide a great variety of equipment largely devoted to supporting the pilot and his crew. The necessity for cockpit air conditioning, for example, now demands elaborate equipment in high-speed aircraft; also required are suitable clothing, easily interpreted and reliable instrumentation, a whole new range of flying controls and improvements in the standard survival and escape equipment. British military aircraft have not been noted for crew comfort, but considerable effort is now being devoted to producing much of the equipment which has lately become a necessity rather than a luxury. The static display at Farnborough was, therefore all the more interesting in that it showed how the industry is dealing with modern requirements.

One type of equipment all too recently adopted from America's excellently furnished larder is the air turbine motor in many of its forms and applications. **Normalair** showed on their stand a licence-produced AiResearch cabin air conditioning pack, 15½in long, weighing only 5.8 lb and capable of producing 10 lb of air per minute at −15 deg C, with 0.67 tons refrigeration capacity. They also showed a venturi-type cabin air humidifier, automatic airflow control valves and very small cooling turbines.

Such accessories are now required to maintain cabin temperatures at acceptable level during flight in ambient-temperature extremes caused by altitude, speed or climate. Normalair also manufacture the demand oxygen regulator Mk 17, which provides automatic oxygen supply with partial pressure breathing from 10,000ft, and full pressure breathing from 25,000ft. In conjunction with the Mk 17 regulator the new Type NC pressure breathing mask was exhibited. This is one of a new series of masks which, instead of covering the face—including the jaw—cupwise, rest on the chin and across the nose, use being made of a soft rubber seal.

Among their manifold interests, the **Airscrew Company and Jicwood, Ltd.**, have come a long way during the past two or three years in the development of airborne fan systems. Last year a novel squirrel-cage centrifugal fan from the Victor was displayed; this year one of the chief exhibits was the recirculating fan for ventilating the Viscount. This unit has a pair of contra-rotating ducted fans, each driven by a B.T.H. motor of 0.29 h.p. A similar, but larger, unit is going into production for the Beverley.

For airline operation in hot climates, cooling of cabins while aircraft are on the ground is often essential; and in this connection the well-known "Coolair" unit made by **M.L. Aviation** was among the outdoor static exhibits at Farnborough.

Rotol showed an emergency ram-air turbine which, should the main generating system fail, can be extended into the airstream to provide a generator drive of substantially constant r.p.m. through the use of blades whose pitch varies under aerodynamic load. The turbine had been tunnel-tested at speeds between 130 kt and Mach 1.

A wide range of flight instrumentation was to be seen, particularly on the **Sperry, Smiths** and **Kelvin and Hughes** stands, and **Ferranti** were also showing an artificial horizon to the R.A.F.'s Mk 3B standard. It was electric, with a 360-deg freedom in roll and 85 deg in dive or climb, fast-erection push button, failure-warning flag, and 20-sec maximum erection time.

Mechanism, Ltd., showed a range of cabin altimeters, Mach-Meters, both simple and contacting, and an experimental combined Machmeter/A.S.I. The latter was designed to show low airspeeds (up to 260 kt) and high Mach numbers (up to Mach 1.3) by two pointers, a movable critical Mach bubber line being automatically adjusted to show maximum speed for the aircraft's altitude.

Ultra Electric showed Sarah (search and rescue and homing) as it is being progressively installed in the standard R.A.F. Mae West, and **Burndept** have a comparable equipment called Talbe (talk-and-listen beacon equipment) which may be ordered for the Royal Navy. Both these exhibits are referred to on page 479 of this issue.

On the **R.F.D.** stand was a wide variety of civil and military survival equipment, including the new K-type one-man dinghy with integral inflatable exposure suit. **P. Frankenstein and Sons** showed an inflatable exposure suit designed to be easier and quicker to put on than the standard Service pattern. **Howard Flint** showed various types of aircrew cold-weather outer clothing and a plastic visor attachment for the new D-type cloth helmet.

What might be termed a "preliminary to survival" was exhibited by **M.L. Aviation,** in the form of a cartridge-operated underwater hood-jettisoning gear combined with the normal spring-balanced hood-opening mechanism; it was designed for the Sea Venom. Here also was a waterproof electrical relay, working happily underwater.

Changes in the trend of ejection-seat design were typified by the new **Martin Baker** Mk 3 automatic seat for the V-bombers and the Mk 4 lightweight automatic seat for future applications. Another interesting seat design was that shown in conjunction with the Gnat components on the Folland stand—the Saab-Folland seat; incidentally, the **Folland** seat is said to bear comparatively little resemblance to its Swedish prototype. Both the M.B. Mk 4 and the Folland seats feature combined seat and parachute harness, leg lashings and automatic seat and parachute release. Both also weigh something under 50 lb installed. The larger Mk 3 bomber seat also has leg lashings instead of thigh guards, but otherwise resembles the standard R.A.F. Mk 2 automatic seat which has almost totally replaced the old manual type in the Service.

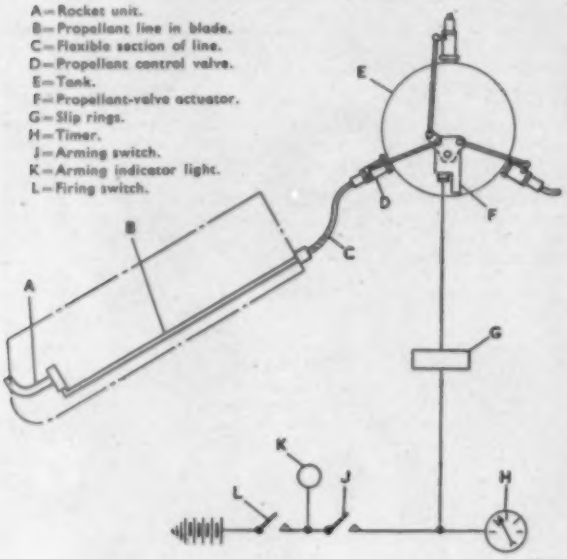
The parachute of the Folland seat was designed specially by **G.Q., Ltd.**, and contains barostatic parachute opening control, plus emergency oxygen supply for the pilot to use during a long descent. Also on the G.Q. stand was the latest air-ventilated aircrew inner suit, the Mk 2, which has been extended to cover the whole leg and arm and has an additional lead for a head-cooling cap. Finally there were the partial-pressure helmet (to go with the p.p. suit) designed by G.Q. and somewhat modified since it appeared last year, and the new 3,000lb-capacity cargo parachute, constructed in five detachable sections for quick repair in the field. The spaces between the detachable sections give the impression of four blank gores.

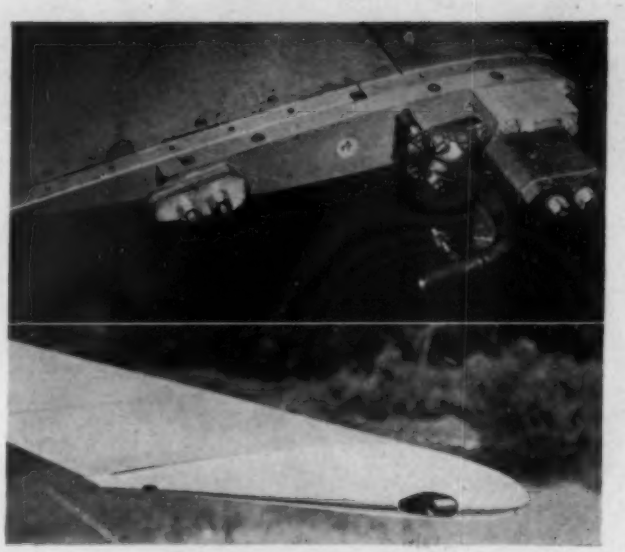
Items of particular interest from the pilot's point of view were the powered controls on the **Lockheed. Boulton Paul, Hobson, Fairey, British Messier** and **Armstrong Whitworth** stands. Most of these units cannot be mentioned in relation to any specific aircraft. Hobson showed a rig for providing "Q feel" (control stiffness increasing as the square of the increase in speed) up to critical Mach number and then a relaxation in stick load. The Midge tailplane gear (also by Hobson) provides continuous feel through the mechanical tailplane and electric trim motor integral with the tailplane actuating screwjacks. Armstrong Whitworth showed a non-linear geared system with trimmer and feel units designed to decrease control response near the control column neutral position and thus to prevent over-controlling by the pilot at very high speeds. Of developments in this sphere it is hoped to say more in a future article.

A cabin-air-conditioning pack produced by Normalair under licence from AiResearch, U.S.A. The Unit produces 10 lb of thermostatically controlled air per minute from a compressor bleed and through a ram air heat-exchanger and an expansion turbine.

ROCKET ASSISTANCE FOR HELICOPTERS

INTO the aeronautical dictionary now comes "ROR," meaning Rocket On Rotor or, more explicitly, the application of liquid-propellant rockets, mounted on the tips of conventional helicopter blades to increase power. Designed and developed by Reaction Motors, Inc., of Rockaway, New Jersey, the system has already been applied to the Sikorsky HRS-2 (S-55 type) helicopter of the U.S. Marine Corps. The requirement arose from experience in Korea, where it was found that helicopters could carry only three wounded men off a ridge 5,000ft high, whereas at sea level they could carry six. By the use of ROR additional power, equivalent to a 20 per cent increase in engine output, is obtained. Including tankage, the system weighs 67 lb and, apart from its major benefits, is claimed to improve glide performance and control with the main engine out, and to benefit rate of climb and hovering ceiling. The fuel is hydrogen peroxide, which is decomposed catalytically and is transformed into high-temperature steam. No flame or smoke, and very little noise, is said to result. The dome-shaped tank, mounted on the rotor hub and carrying fuel for six minutes (enough for 20-25 take-offs) is seen in the photograph on page 474.





These photographs illustrate how, when the tip fairing is installed on a rotor blade having ROR assistance, only the extreme end of the propelling nozzle is visible. (Left) Schematic diagram showing ROR applied to a Sikorsky HRS-2 (S-55 type) helicopter.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Club Rates and Liabilities

I WAS greatly interested in your recent editorial on flying clubs, but there are some aspects you have overlooked.

I recently joined a local flying club and am receiving instruction at the rate of £3 8s per hour, which is quite an expensive way of spending one's time. When I have learned it will be no use to anybody but will presumably have helped to keep a civilian airfield open and will give me pleasure.

What staggered me was that I had to sign an agreement absolving the proprietors of the club from all responsibility for anything that might happen to me in connection with the club but agreeing to indemnify the proprietors for anything that I might do. This indemnity applies not only to me but also to my heirs and successors. This seemed so wide that I protested, but was told that it was the usual form of agreement. All my common law rights have been signed away. I might be poisoned by the beer, or the roof might fall on me and I would have no claim, whereas I or my family might have to support the dependants of someone to whom I had told an exciting story on the club premises, and who had died of blood pressure as a result.

There are many expenses besides direct tuition in flying, such as medical fees, insurance, etc. To have one's neck so far stuck out in the legal sense seems an unnecessary addition.

Surrey. LEARNER.

Thoughts from Australia

A RECENT article in the *Sidney Morning Herald* described a plan to operate the Princess flying-boats between Britain and Australia *via* Central America and Tahiti, and New Zealand. The excuse most often advanced for not employing them is that there is no suitable engine available. A simple solution might be to use six Proteus 755s plus two Avons, pylon-mounted.

This arrangement would give 24,900 e.h.p.+22,000 lb s.t. for take-off and climb to operational altitude. Take-off with fuel for design maximum range should then be possible. If cruising power at operational altitude on the six Proteus is still not sufficient, the aircraft might be climbed on all engines to 5,000ft above cruise altitude and then allowed to drift down at say 100ft/min. After 50 min the reduced weight might permit level flight at the required T.A.S. on Proteus alone.

On another subject—to show the need for new transport aircraft within the R.A.A.F.—the recent exercise "Tropic Strike" at Darwin employed only three operational squadrons. Transport support, however, required *all* the uncommitted resources of transport aircraft in the R.A.A.F. No doubt two or three Beverleys could have done a much better job.

At the moment the Air Force has no mobility apart from that of the combat aircraft and their aircrew and "concentration of force" is a dream in any area remote from squadron bases. As for procurement of aircraft in the strike-fighter class we are building a good light bomber, the Canberra B.2, instead of the intruder version. Perhaps the idea is to sink small ships with bombs dropped from 35,000ft aimed by a Mk. 14 sight.

We should already be building the Canberra intruder and tooling up for something in the class of the Vautour or the Supermarine 525, equipped with cannon and with a good missile which can engage a target outside 37 mm range. However, those directly concerned may never have read of these aircraft.

Sydney, Australia. JOHN D. ALFORD.

Hearing the Show Commentary

AS a visitor to the Farnborough Air Show I would like to express my admiration for the designers and pilots who, this year as in other years, gave proof that British aircraft and the men who fly them are second to none in the world.

I regret I cannot say the same for the sound-reinforcement system installed there. Over quite a large area of the concourse one could either hear two speakers separated by a short time-interval, which resulted in complete unintelligibility, or one could hardly hear anything at all. As far as one could judge the system was entirely dependent on the prevailing wind.

Hayes, Kent. J. M. BAKER.

CIVIL AVIATION

SUPER-CONNIE FREIGHTER

CLAIMED by Lockheed to be the "fastest and largest commercial cargo airplane ever built" the first of four L.1049B Super Constellations ordered by Seaboard and Western Airlines was delivered on September 7th. The aircraft, which will be capable of lifting 18 tons of freight across the Atlantic, has an 83ft main cargo compartment with large loading doors fore and aft and a strengthened floor of extruded magnesium. It can be converted for troop carrying work in less than an hour by the installation of a galley and seats for 109 passengers. The ambulance version of the L.1049B will carry 73 stretcher patients.

Seaboard and Western have announced that the new aircraft will be used to operate a six-month military contract for the carriage of freight, service personnel and their dependents between the United States and Western Europe. The contract, which is valued at more than $3,000,000 (£1,071,000), takes effect on October 1st.

J.A.T.O. is sometimes used by the two Convair 240s operated from Addis Ababa, 8,000ft above sea level, by Ethiopian Airlines. These aircraft are the only examples of this type operating regularly within the African continent, serving Nairobi, Athens and Cairo. Last year their average daily utilization reached 4 hr 18 min, compared with 3 hr 24 min in 1952.

FRIENDSHIP GROUND-TESTING

THE latest in a series of progress reports issued by the Fokker works on their F.27 Friendship outlines the static and fatigue test programme. In addition to the two prototypes due to fly next year, the main components for a third aircraft are being built for this purpose.

Fatigue bending tests of the complete F.27 wing, it is stated, will be undertaken according to the newest method developed by the R.A.E. at Farnborough. In a large concrete basin now under construction, the pressure hull will be immersed and subjected to twice the normal working differential by means of water pressure. There will also be a combined test of the fuselage under ultimate bending loads occurring in flight without cabin pressure, and under one and a half times the working pressure. Other static tests will be as follows:—Ultimate landing load on inner wings and fuselage, critical for torsion and shear of inner wing, wing/fuselage attachment and bending of the rear fuselage; ultimate bending load of wing.

Detail tests will be carried in accordance with the Netherlands Civil Airworthiness Requirements under the supervision of inspectors of the Dutch equivalent of the A.R.B. (the Rijksluchtvaartdienst) and will include the following:—Static panel tests on all critical panel configurations of wing, fuselage and tail surfaces; fatigue tests on typical stringer joints in tension; pressure tests on cabin and windshield glass panels; shear test on cabin window structure; and leakage test on integral tank test-piece under fluctuating loads.

DC-7C IN PRODUCTION

LAST week the Douglas Aircraft Company announced that the DC-7C, which will be known by the fortuitously apt name of Seven Seas, has entered production at Santa Monica, California. First examples of the DC-7C are expected to go into service in the summer of 1956 with Pan American World Airways, who have ordered 15. Delivery of PanAm's initial batch of six is scheduled to begin in June 1956.

The DC-7C represents yet another phase in the process of "stretch" which began with the evolution of the DC-6 from the original DC-4, and is shown in detail by the figures quoted below.

Type	Gross weight (lb)	Span ft in	Length ft in	Total take-off-power (h.p.)
DC-4	73,000	117 6	93 11	5,800
DC-6	97,200	117 6	100 7	9,600
DC-6B	107,000	117 6	105 7	10,000
DC-7	122,000	117 6	108 11	13,000
DC-7B	125,000	117 6	108 11	13,000
DC-7C	140,000	127 6	112 3	13,000

The designed gross weight of the DC-4 was only 50,000 lb, whereas the DC-7C will be nearly 200 per cent heavier; engine power has more than doubled, and the fuselage is almost 20ft longer. Until the advent of the Seven Seas, stretching was confined to the fuselage, but the new Douglas transport will have (in addition to a fuselage extension of 3ft) 10ft more wing-span and a 2ft higher vertical tail. By comparison with the DC-7, the DC-7C's extra wing-span will enable fuel capacity to be increased from 6,400 to 7,860 (U.S.) gallons. The 3,250 h.p. Wright Turbo-Compound engines are retained, but, since the additional wing-span is being built in at the centre section, they will be installed 5ft farther from the fuselage, so reducing noise-level.

In view of its non-stop transatlantic potentialities, the Seven Seas seems likely to be used initially for premium first-class rather than tourist services. In luxury form it will carry 62 passengers, plus baggage, cargo and mail; the equivalent range "with adequate reserve fuel," say Douglas, is 5,000 miles. The company's vice-president commercial sales, Mr. Nat Paschall, describes the Seven Seas as the first transport designed to fly non-stop from Europe to New York with a full payload under adverse winter wind conditions. It should also be capable, it is claimed, to cover the 4,793 miles between Tokyo and Seattle without a refuelling stop.

Tests are now being performed with the prototype DC-7B, which is basically similar to the DC-7 but carries additional fuel in "saddle" tanks built into the engine nacelles, and will have a gross weight of 125,000 lb. Last December PanAm announced an order for seven DC-7Bs at a total cost of $14m.

Christchurch-bound, a DC-3 of New Zealand National Airways turns on to the runway at Paraparaumu, Wellington's major airport. The signal lights and bell in the foreground, which warn motorists on the main road of approaching aircraft, are similar to those at New Zealand's gateless railway crossings.

CIVIL AVIATION . . .

THE AIRLINE PARLIAMENT

PARIS was last week the setting for the 10th annual meeting of I.A.T.A., which was held in the Hotel de la Rochefoucauld from Monday to Friday inclusive. On the opening day, Sir William Hildred, director-general, presented his annual report, and M. Max Hymans (Air France) took over from Mr. Gordon McGregor (T.C.A.) as president for 1954-55. Subsequently the reports of I.A.T.A.'s various committees—executive, technical, traffic, financial, legal, medical—were presented and discussed by delegates of the 70 member airlines. We hope to review the highlights of these reports in next week's issue. Outside conference hours, the delegates, many accompanied by their wives, were entertained by the French member-airlines—Air France, Aigle Azur, Air Algérie, T.A.I. and U.A.T.—and by the French Government.

At the closing session, it was unanimously agreed that the 1955 annual meeting would be held in the United States at a time and place to be determined later, and that Mr. Juan Trippe, president of P.A.W.A., should take office there as the 1955-56 president of I.A.T.A.

Two important resolutions were passed at the closing session. The first, noting that European I.A.T.A. operators continued to experience interference by military aircraft on established air routes, called for urgent action to "alleviate this unsatisfactory situation." The resolution urged I.C.A.O. to consider the formation of a unified body capable of co-ordinating the airspace requirements of military and civil aviation, and, as an interim measure, to introduce a uniform procedure for reporting "incidents."

The second resolution, in condemning the passenger service charges levied by certain governments, noted that such charges cover only to a minor extent the cost of airport operation but, on the other hand, "automatically delay the time when, thanks to increased traffic, the airports will be self-supporting."

AIRWORK'S NEW TROOPING CONTRACT

PROVIDING for the carriage of 7,000 troops per year between the United Kingdom and Singapore, the Air Ministry Far East trooping contract has been placed with Airwork, Ltd. Stated to be the biggest single trooping contract ever placed by the Ministry, it runs for 2½ years and is valued at "at least £1¼m."

The flights, which will complete the 9,000-mile journey in three days (compared with four weeks by troopship) will be operated exclusively with Hermes IVAs carrying 68 passengers in 9g rearward-facing seats. Commenting on the announcement, Sir Archibald Hope, joint managing director of Airwork, stated: "This is a very important extension of air trooping. . . . I think the War Office have shown considerable imagination and foresight in deciding to use air transportation for such large numbers over such a long distance."

AN ICED-UP RAPIDE

THE accidents investigation branch of the M.T.C.A. has published its report on the accident to Rapide G-AFMF on February 19th. The Rapide, flown by Mr. B. K. Waugh and operated by John Weston Adamson (trading as Oldstead Aircraft), took off from Woolsington Airport, Newcastle, for a charter flight to Dublin. About ten minutes after take-off, when flying in cloud, the pilot saw ice forming on the wing leading edges and found that the aircraft would not climb above 3,200ft. Shortly afterwards he lost control of the aircraft, which struck the ground in a level attitude while he was trying to regain control. Fire broke out but the pilot and seven passengers escaped serious injury.

The report holds the pilot responsible for the accident "in that he did not exercise care when studying the weather forecasts [which gave the freezing level as 1,500ft] and in consequence made a flight which should not have taken place."

During the investigation the pilot stated that he had chosen a cruising level of 6,000ft, as he thought the forecast freezing level to be 15,000ft. The investigators found, however, that the holder of a commercial pilot's licence should have had sufficient knowledge of meteorology to realize that such a forecast, which included references to snow and sleet on hills, was most improbable in mid-February.

The airframe and airscrews did not carry de-icing or anti-icing and the flight was, therefore, in contravention of air regulations. Furthermore, the Rapide's radio had not been maintained in accordance with the approved schedule, though there was no evidence to show that it was not serviceable.

CONSTELLATION COSTS

WHILE there is wide appreciation of the extremely high costs of modern aircraft, it is not always easy, even for experienced observers, to ascertain the current market value of a particular type. When manufacturers do quote prices for new airliners, they usually do so in round figures, and the amount paid per aircraft by specific operators is not often disclosed by either party. The values of second-hand aircraft vary greatly according to the availability of the type concerned, the condition of individual aircraft and the area in which the sale takes place.

At the end of August B.O.A.C. announced that they were transferring seven Constellation 049s to Capital Airlines in exchange for Capital's seven model 749As and that " a financial adjustment was involved." The adjustment obviously represented the difference in value between the British Corporation's relatively old, early-type Constellations and Capital's more modern versions, with better payload-range performance. At the time B.O.A.C. were unwilling to reveal the sums involved and we hazarded a guess (*Flight*, September 3) that the current market value of a Constellation 749A was "rather more than £300,000" and that the 049's value might be 10 to 20 per cent lower.

Further details of the exchange have now been given by the president of Capital Airlines, Mr. J. Carmichael, in a letter to shareholders. This states that for the seven Constellation 749As Capital will receive $3,850,000 (£1,375,000) in addition to B.O.A.C.'s seven model 049s. For the purpose of the transaction, the Capital aircraft were valued at some £3,375,000 and the B.O.A.C. aircraft at £2,000,000. On this basis, the market value of a Constellation 749A is seen to be not far short of £500,000, or £200,000 more than that of a Constellation 049. Our original paragraph, therefore, under-estimated considerably the price which B.O.A.C. will pay (in dollars) for standardizing their Constellation fleet. Against this, however, the Corporation states that it picked up some £1,250,000 on the book value of the Constellation 049s, and that the transaction was therefore mutually advantageous.

BREVITIES

A SPOKESMAN for Lufthansa is reported to have stated that the next type of aircraft ordered by the German airline will be the Vickers Viscount. The German Ministry of Transport has applied for authority for the company to begin operations this autumn.

* * *

M.T.C.A. traffic statistics for the United Kingdom airlines during May show a 10 per cent drop in capacity and a four per cent reduction in ton-miles flown in relation to the corresponding figures for May 1953. Much of this decline was attributed to a drop in B.O.A.C.'s traffic, particularly on the western routes (due partly to the suspension of South American services following the grounding of Comets); B.E.A.'s ton-mile traffic increased, however, by 15 per cent, and independent airlines operating scheduled services increased their traffic by nearly 40 per cent.

* * *

The Frye Airline Performance Trophy for 1953 has been awarded to Pan American World Airways for their exploitation of jet streams between Tokyo and Honolulu. This 3,846-mile route, flown non-stop by Stratocruisers, is the longest stage regularly flown by an American flag airline. By making use of the 80-100 m.p.h. high-altitude tail-winds, PanAm have achieved an average block speed of 334 m.p.h. between Tokyo and Honolulu.

On September 7th, El Al Israel Airlines inaugurated a fortnightly freight service from Israel to Copenhagen and Helsinki. The service, which is operated by C-46 Commando, leaves Tel Aviv at 7 a.m. on Tuesdays, arriving at Copenhagen at 12.30 p.m. on Wednesday and at Helsinki at 4.30 p.m.; return flights leave Helsinki at 6 a.m. on Thursdays, calling at Copenhagen at 10 a.m.

* * *

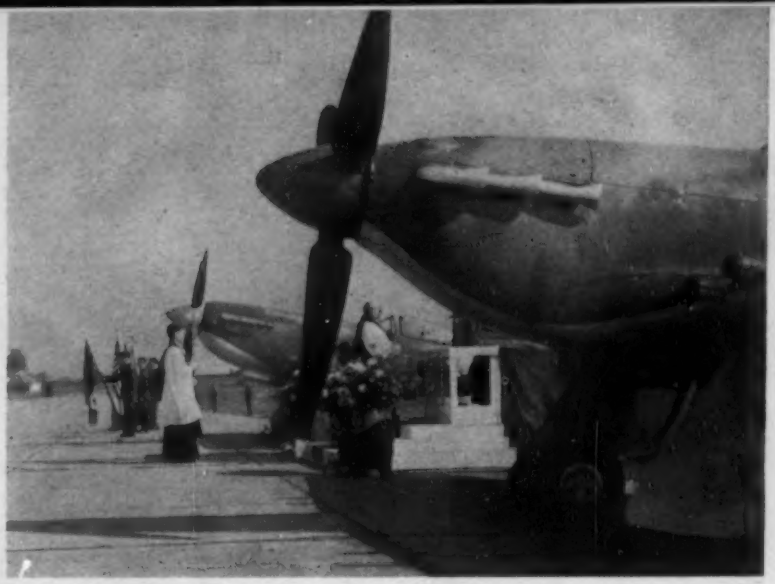
H.R.H. the Duke of Edinburgh will preside at ceremonies celebrating the 25th anniversary of the Guild of Air Pilots and Air Navigators of the British Empire. Ceremonies, which will include an address by the Duke of Edinburgh, who is the Grand Master of the Guild, and the presentation of trophies and awards, will take place at the County Hall, Westminster Bridge, London, S.E.1, on the evening of November 30th.

* * *

Although Silver City Airways' private airport at Ferryfield came into operation only on July 13th, M.T.C.A. airport statistics for the month show that the total tonnage handled there (4,798) was greater than at any other airport in the United Kingdom. Of 14,100 tons of freight set down and picked up from British airports in July, some 70 per cent was in the form of vehicles and other cargo carried by Silver City to and from Ferryfield, Lympne and Southampton. Initial figures for August suggest that during the month Ferryfield handled 6,500 tons—nearly half the total traffic for all U.K. airports.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News



At Biggin Hill on Sunday a Hurricane (foreground) and a Spitfire were dedicated, as permanent reminders of the Battle of Britain, by Dr. Chavasse, Bishop of Rochester.

BATTLE OF BRITAIN WEEK

THE anniversary of the Battle of Britain was again marked this year by a number of ceremonies, exhibitions, displays and services throughout the country and in R.A.F. commands overseas. On September 15th the London fly-past was held (picture overleaf). On the ground, aircraft were shown in public places; in particular, the now-traditional group of British and German war-time types was assembled on the Horse Guards' Parade in London (a photograph appeared in *Flight* last week).

The reunion of those who fought in the Battle took place this year at Biggin Hill, and about 100 of "The Few" gathered there, senior officers including Air Chief Marshal Lord Dowding and Air Marshal Sir Dermot Boyle, the Cs.-in-C. of Fighter Command then and now. The reunion has previously taken place at H.Q. Fighter Command, Stanmore, but this year it was decided to hold it at one of the Battle of Britain stations.

On the final Sunday of Battle of Britain Week, commemorative services were held all over the country, the principal of which was in Westminster Abbey. A parade of 750 troops drawn from all the arms which took part in the Battle marched to Westminster Abbey, with the Queen's Standard for the R.A.F. flying. The Queen was represented by Air Chief Marshal Sir Arthur Sanders, and the Prime Minister by Mr. Fitzroy Maclean, M.P. Many relatives of those who fell in September 1940 were present at the service, which was conducted by Canon Leslie Wright, former R.A.F. Chaplain-in-Chief. Two minutes' silence was observed. The Fighter Command Standard was carried and escorted into the Abbey by three Battle of Britain pilots. On his way to this service the Chief of the Air Staff, Air Chief Marshal Sir William F. Dickson, laid a wreath at the foot of the R.A.F. Memorial on the Embankment.

A drumhead service was held at Biggin Hill on the morning of September 19th, during which the Bishop of Rochester, Dr. Chavasse, dedicated a Spitfire and a Hurricane which are to be permanently parked in front of the Battle of Britain Chapel on the station. Air Marshal Sir Dermot Boyle presented the new station badge to the station commander, W/C. D. G. Smallwood. The motto, *The Strongest Link*, refers to Biggin Hill's part in the Battle.

On Saturday last, 56 stations were "at home" to members of the public, and a number of outstanding flying displays and a great variety of static displays and amusements were provided. Many of these displays in fact had the aspect of a miniature Farnborough Show, with additional interest provided by the fact that "old-timers" and some of the lesser-known Service types were included.

The Victor and a production Valiant appeared at a number of stations in South-East England; a Bristol Fighter and a Sopwith Pup staged a dog-fight at Biggin Hill; a large formation of Provosts toured various airfields; and a number of Sunderlands and formations from the Fleet Air Arm did likewise. Formations of many different kinds made tours, so that each station would be able to provide a view of the maximum variety of aircraft types. Fighter Command alone provided no fewer than 17 large formations.

In Scotland and the North of England the Army also took a hand in demonstrating air-to-ground co-operation and in staging airfield attacks with armoured vehicles. Noisy interludes were provided in many places by the destruction of "battleships" and "fortresses" under simulated air attack. Paratroops demonstrated drops from balloons and aircraft.

The first Hunters and Swifts to reach the R.A.F. were kept busy, and practically every recognized formation-aerobatics team in the Service gave demonstrations. A record total of 1,208,500 people attended the displays.

Australia's Fleet Air Arm

THIS month the Royal Australian Navy's Fleet Air Arm celebrated its sixth birthday with a special display at its main base, H.M.A.S. *Albatross*, Nowra, New South Wales.

A birthday parade was held, after which No. 817 Squadron (Fireflies) flew off to join two other squadrons in the aircraft carrier H.M.A.S. *Sydney*, lying off Nowra.

Since 1948, when the base at Nowra was but a clearing in the bush, the site has changed until today it is the main Naval air base in Australia, with accommodation for six squadrons. The station commanding officer is Capt. R. Rhoades.

The expansion of H.M.A.S. *Albatross* and the introduction of 2,000 Navy men has transformed Nowra into a prosperous garrison town. Owing to the difficulty of finding accommodation for wives and families the Navy built 150 prefabricated houses as well as converting 15 buildings into flats and 20 Nissen huts into cottages.

During its infancy the Royal Australian Navy's air arm relied to a great extent on British personnel, loaned from the Royal Navy. Today all the pilots are Australian, but there is still an interchange of specialist officers.

At present the operational aircraft are Sea Fury single-seater fighters and two-seater Fireflies for anti-submarine and reconnaissance work. Pilots are now carrying out jet conversion courses on Vampire trainers. Later this year No. 808 Squadron will come to England to convert to de Havilland Sea Venoms. Fairey Gannets will replace the Fireflies next year.

R.Aux.A.F. Appointment

THE Air Ministry has announced the appointment of S/L. D. J. Harrison to Command No. 3521 (North Lancashire) Fighter Control Unit, R.Aux.A.F., located at Squires Gate, Blackpool.

S/L. Harrison first joined the R.A.F. in the ranks in 1918 and later, in 1925, was granted a short service commission. He was on flying duties until his release from the Service in 1946.

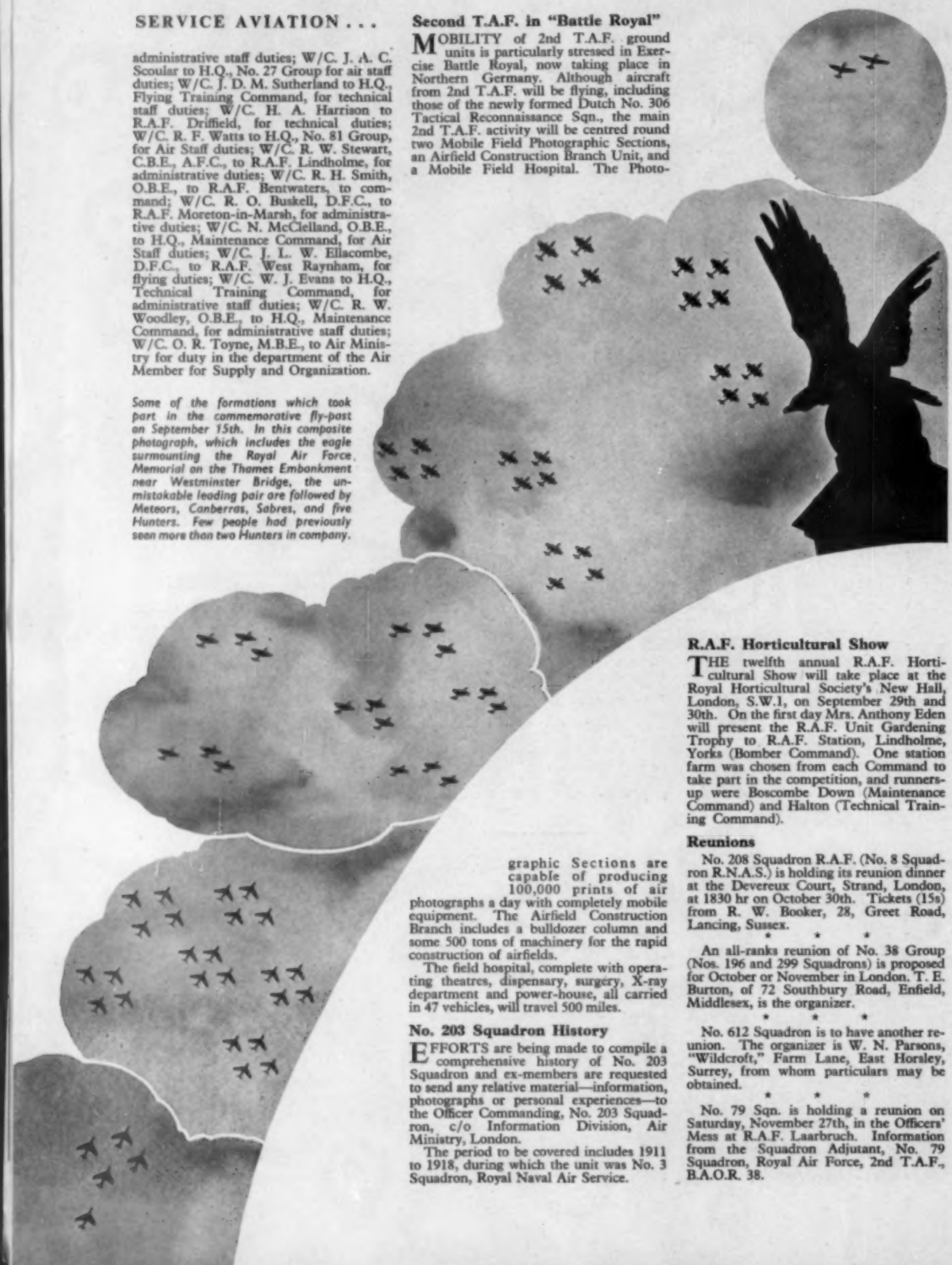
The appointment is also announced of S/L. R. McCarthy, A.F.C., to command No. 3506 (County of Northampton) Fighter Control Unit, R.Aux.A.F., based at Peterborough. S/L. McCarthy enlisted in the R.A.F.V.R. in 1937 and, on active service after 1940, was a flying instructor until his demobilization in October, 1945. He was awarded the A.F.C. in 1943, and the Air Efficiency Award in 1944. He joined the R.Aux.A.F., Flying Control Branch, as a squadron leader last year.

R.A.F. Appointments

THE following Royal Air Force appointments were recently announced G/C. G. F. Powell-Shedden, D.S.O., D.F.C., to Air Ministry for duty in the department of the Air Member for Supply and Organization; G/C. F. J. M. Pryer to H.Q., Maintenance Command, for

SERVICE AVIATION . . .

administrative staff duties; W/C. J. A. C. Scoular to H.Q., No. 27 Group for air staff duties; W/C. J. D. M. Sutherland to H.Q., Flying Training Command, for technical staff duties; W/C. H. A. Harrison to R.A.F. Driffield, for technical duties; W/C. R. F. Watts to H.Q., No. 81 Group, for Air Staff duties; W/C. R. W. Stewart, C.B.E., A.F.C., to R.A.F. Lindholme, for administrative duties; W/C. R. H. Smith, O.B.E., to R.A.F. Bentwaters, to command; W/C. R. O. Buskell, D.F.C., to R.A.F. Moreton-in-Marsh, for administrative duties; W/C. N. McClelland, O.B.E., to H.Q., Maintenance Command, for Air Staff duties; W/C. J. L. W. Ellacombe, D.F.C., to R.A.F. West Raynham, for flying duties; W/C. W. J. Evans to H.Q., Technical Training Command, for administrative staff duties; W/C. R. W. Woodley, O.B.E., to H.Q., Maintenance Command, for administrative staff duties; W/C. O. R. Toyne, M.B.E., to Air Ministry for duty in the department of the Air Member for Supply and Organization.



Some of the formations which took part in the commemorative fly-past on September 15th. In this composite photograph, which includes the eagle surmounting the Royal Air Force Memorial on the Thames Embankment near Westminster Bridge, the unmistakable leading pair are followed by Meteors, Canberras, Sabres, and five Hunters. Few people had previously seen more than two Hunters in company.

Second T.A.F. in "Battle Royal"

MOBILITY of 2nd T.A.F. ground units is particularly stressed in Exercise Battle Royal, now taking place in Northern Germany. Although aircraft from 2nd T.A.F. will be flying, including those of the newly formed Dutch No. 306 Tactical Reconnaissance Sqn., the main 2nd T.A.F. activity will be centred round two Mobile Field Photographic Sections, an Airfield Construction Branch Unit, and a Mobile Field Hospital. The Photographic Sections are capable of producing 100,000 prints of air photographs a day with completely mobile equipment. The Airfield Construction Branch includes a bulldozer column and some 500 tons of machinery for the rapid construction of airfields.

The field hospital, complete with operating theatres, dispensary, surgery, X-ray department and power-house, all carried in 47 vehicles, will travel 500 miles.

No. 203 Squadron History

EFFORTS are being made to compile a comprehensive history of No. 203 Squadron and ex-members are requested to send any relative material—information, photographs or personal experiences—to the Officer Commanding, No. 203 Squadron, c/o Information Division, Air Ministry, London.

The period to be covered includes 1911 to 1918, during which the unit was No. 3 Squadron, Royal Naval Air Service.

R.A.F. Horticultural Show

THE twelfth annual R.A.F. Horticultural Show will take place at the Royal Horticultural Society's New Hall, London, S.W.1, on September 29th and 30th. On the first day Mrs. Anthony Eden will present the R.A.F. Unit Gardening Trophy to R.A.F. Station, Lindholme, Yorks (Bomber Command). One station farm was chosen from each Command to take part in the competition, and runners-up were Boscombe Down (Maintenance Command) and Halton (Technical Training Command).

Reunions

No. 208 Squadron R.A.F. (No. 8 Squadron R.N.A.S.) is holding its reunion dinner at the Devereux Court, Strand, London, at 1830 hr on October 30th. Tickets (15s) from R. W. Booker, 28, Greet Road, Lancing, Sussex.

* * *

An all-ranks reunion of No. 38 Group (Nos. 196 and 299 Squadrons) is proposed for October or November in London. T. E. Burton, of 72 Southbury Road, Enfield, Middlesex, is the organizer.

* * *

No. 612 Squadron is to have another reunion. The organizer is W. N. Parsons, "Wildcroft," Farm Lane, East Horsley, Surrey, from whom particulars may be obtained.

* * *

No. 79 Sqn. is holding a reunion on Saturday, November 27th, in the Officers' Mess at R.A.F. Laarbruch. Information from the Squadron Adjutant, No. 79 Squadron, Royal Air Force, 2nd T.A.F., B.A.O.R. 38.

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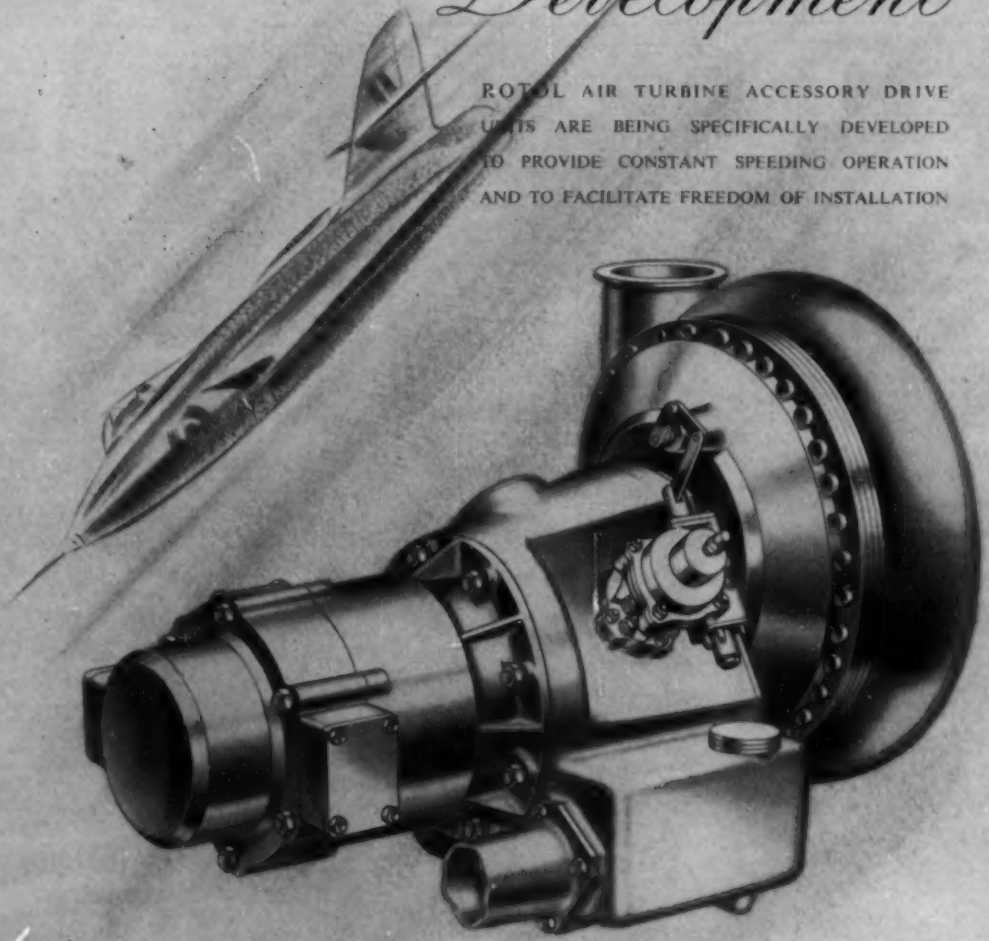

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:

APPLICATION No. 360 from the British Overseas Airways Corporation, of Airways House, Great West Road, Brentford, Middlesex, for a normal scheduled service with Argonaut, Constellation, Comet, Viscount or Bristol Britannia aircraft for the carriage of passengers and supplementary freight and mail on the route London-Frankfurt or Dusseldorf-Rome and/or Athens-Cairo or Beirut or Nicosia-Khartoum-Aden-Entebbe-Nairobi, the service to terminate at Aden or Nairobi at the discretion of the Corporation, at a frequency of one service weekly, increasing further in accordance with traffic demand, for a period of 10 years from October 1954.

FROM East Anglian Flying Services Ltd., of Southend Airport, Essex:

APPLICATION No. 361 for a seasonal normal scheduled service with D.H.89, D.H. Dove, D.H. Heron and/or Marathon aircraft, for the carriage of passengers, supplementary freight and mail between Portsmouth and Le Touquet, with an intermediate traffic stop at Shoreham, at a frequency of from seven to 21 services weekly with duplication of services when required, during the season from April to October inclusive each year for a period of 10 years from April 1st, 1955.

APPLICATION No. 362 for an internal service with D.H.89A and later possibly with Prestwick Pioneer II aircraft, for the carriage of passengers, supplementary freight and mail between Shoreham and the Isle of Wight with an intermediate traffic stop at Portsmouth, at a frequency of from seven services weekly to 28 services daily during a period of 10 years from April 1st, 1955.

APPLICATION No. 363 from Air Charter Ltd., of 15 Great Cumberland Place, London, W.1, for a colonial coach service with Tudor aircraft for the carriage of passengers, supplementary freight and mail between London (Stansted) and Lagos, with an intermediate traffic stop at Malta, at a frequency of 52 services per annum with permission to increase this to a maximum of three services per week should traffic demand, during a period of 10 years from January 1st, 1955.

FROM Fairways (Jersey) Ltd., of Midland Bank Chambers, Mulcaster Street, St. Helier, Jersey, C.I.:

APPLICATION No. 364 for a normal scheduled service with Avro XIX aircraft for the carriage of passengers and supplementary freeight between Jersey and/or Guernsey and Dinard at a frequency of one to 30 services weekly during the season from May to September inclusive for a period of seven years from May 1st, 1955.

APPLICATION No. 365 for an internal service with Avro XIX aircraft for the carriage of passengers and supplementary freight between Jersey and Blackbushe for Reading, with an optional intermediate traffic stop at Guernsey, at a frequency of from two to 30 services weekly during the season from May to September inclusive for a period of seven years from May 1st, 1955.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2618

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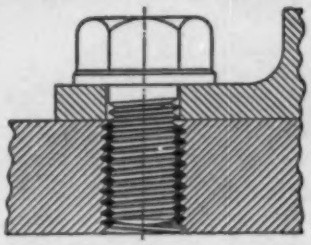

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The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

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APPLY, in writing, to the Director of Recruitment, Colonial Office, Great Smith Street, London S.W.1, giving briefly, age, qualifications and experience. Mention the reference number CDE.57/88/01. [2622

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SENIOR design engineer for rocket motor design and development. Post requires good administrative experience as well as technical ability. H.N.C. essential. —Write, giving full details of age, experience and qualifications to Personnel Manager, Bristol Aeroplane Company Limited, Aircraft Division, Weston-Super-Mare. [2611

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ENGINEERS are required by the Guided Weapons Division of The English Electric Co. Ltd., Luton, for their project offices as follows:

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YOUNG technical assistant with an interest in experimental investigations research by aircraft accessory manufacturer for research work in connection with turbines and allied equipment. Vacancy offers excellent experience and prospects. Pension scheme.—Apply Box 7861. [2604

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DRAUGHTSMEN required in the designs drawing office. These appointments are pensionable and offer good prospects to individuals with initiative and technical ability.—Applications, giving details of experience and qualifications to Personnel Manager, Joseph Lucas (Gas Turbine Equipment) Ltd., Shaftmoor Lane, Hall Green, Birmingham 28. [2612

SAUNDERS-ROE, Ltd., require a senior aerodynamicist with wide experience. Salary range £800 to £1,000. A broad knowledge of supersonics, stability and control and dynamic stability would be considered an advantage.—Men with suitable qualifications and ability are invited to apply to the Personnel Officer, Saunders-Roe, Ltd., East Cowes, I.O.W. [2628

AERODYNAMICISTS. Two senior men with good qualifications are required for interesting work, mainly in connection with high-speed projects which have far-reaching possibilities. Only men able to tackle modern high-speed aerodynamic problems and having the ability to lead a small section on this class of work need apply.

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PUMP manufacturers in South of England seek services of qualified engineer to supervise their aircraft fuel pump department. Appointment calls for a man possessing initiative and pleasing personality, with experience of design and development of new ideas and some commercial knowledge, including procedure of Government Departments is desirable. Give chronological record of training and career and state when available.—Box 7935. [2629

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DESIGNERS and development engineers. Joseph Lucas (Gas Turbine Equipment) Ltd., have vacancies at their Marston Green and Shaftmoor Lane factories. Experience of aircraft electrics or hydraulics would be an advantage, but not essential. These appointments are pensionable and offer good prospects to individuals with initiative and technical ability.—Applications should be sent to Personnel Manager, Joseph Lucas (Gas Turbine Equipment) Ltd., Shaftmoor Lane, Hall Green, Birmingham 28. [2613

JUNIOR engineer for interesting design and development work on electronic and vibration test equipment. Applicants should have O.N.C. or equivalent, a sound knowledge of industrial electronics, be capable of wiring prototype equipment to approved standards and working on own initiative if required to do so. Good welfare facilities including staff pension and insurance scheme. Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Ltd., Luton Airport, Beds., stating age, experience and salary required. [2527

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(c) Assistant grades to work under direction of systems engineers on development work. (Ref. 62).

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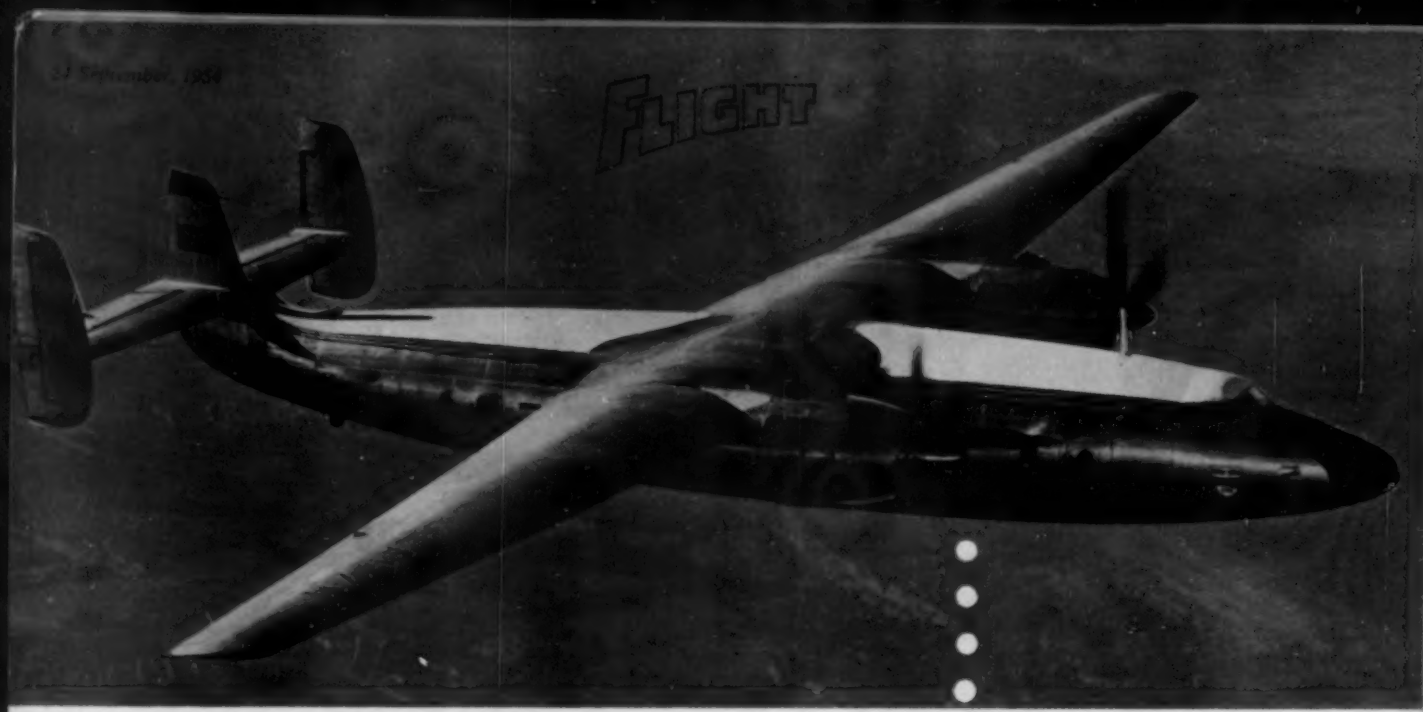

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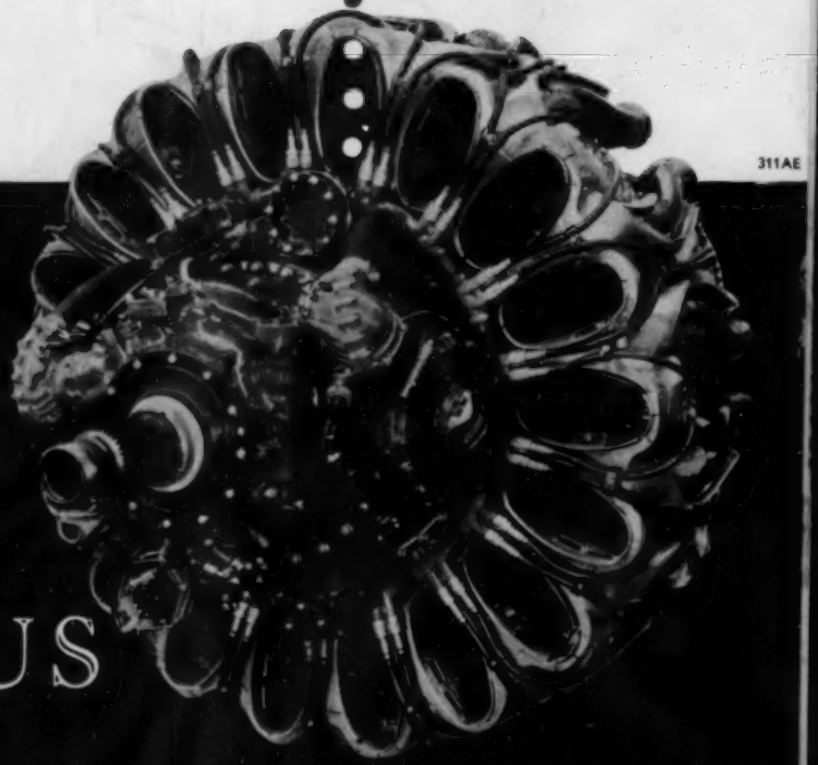

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